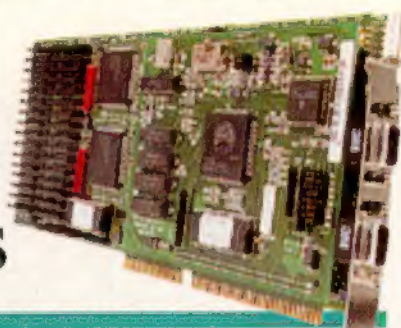


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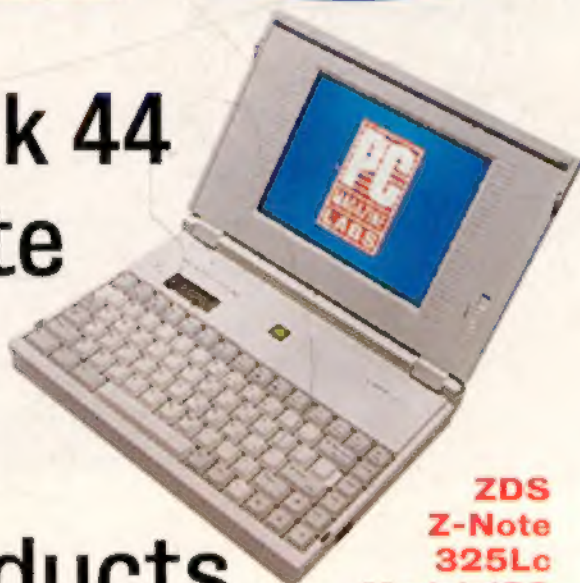


Paradox 4.0
for DOS



The Norton
Desktop for
Windows 2.0

Our Editors Pick 44
Of Their Favorite
Software,
Hardware, and
Peripheral Products

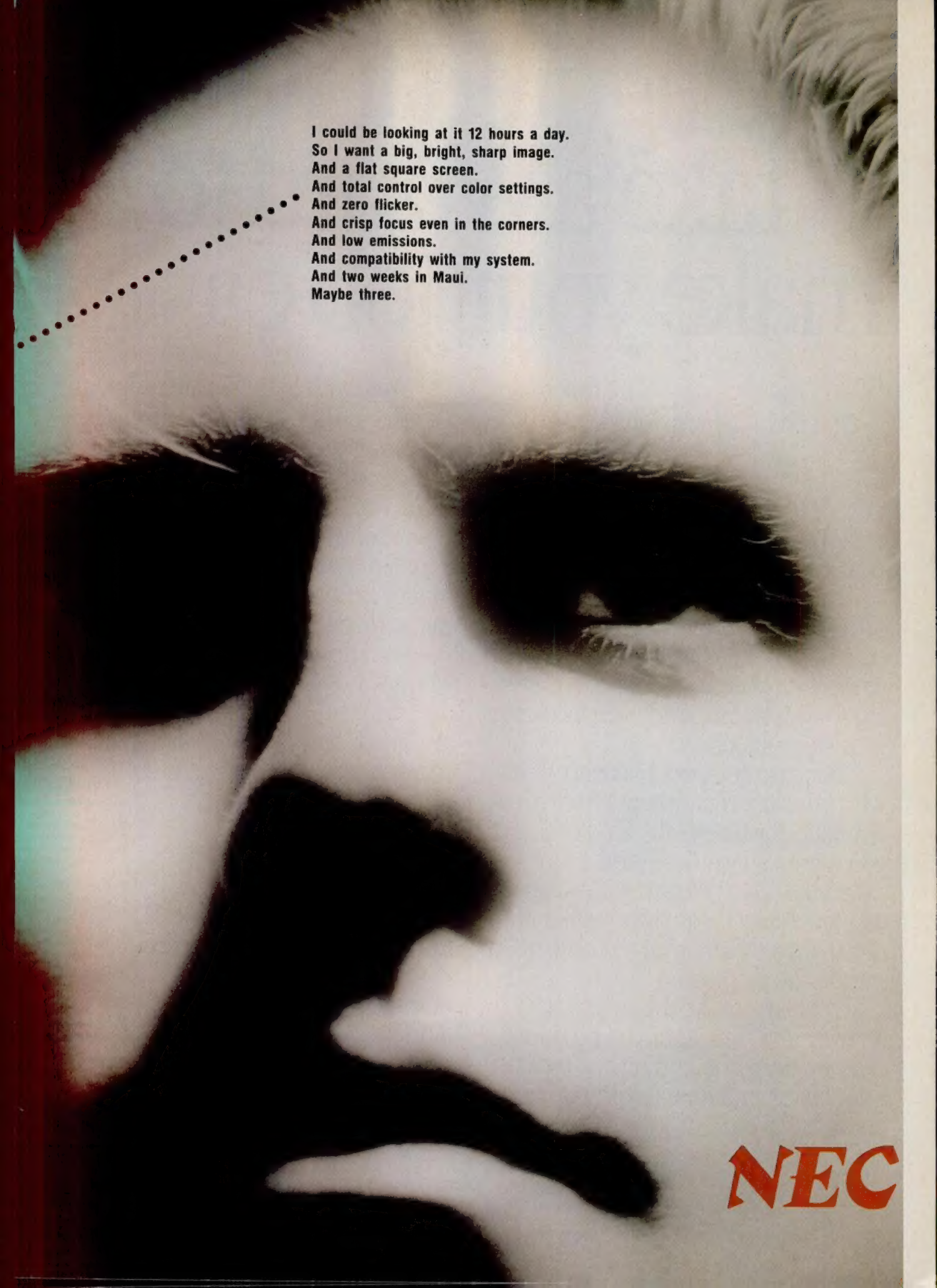


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NEC

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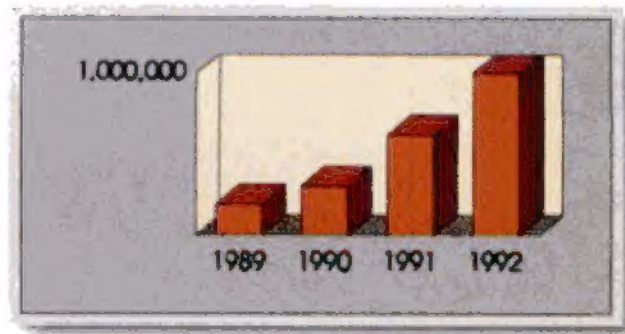
What about the things you have to do over and over again? The things that are time-consuming and tedious? Like filling in dates. Adding up numbers? And formatting worksheets?

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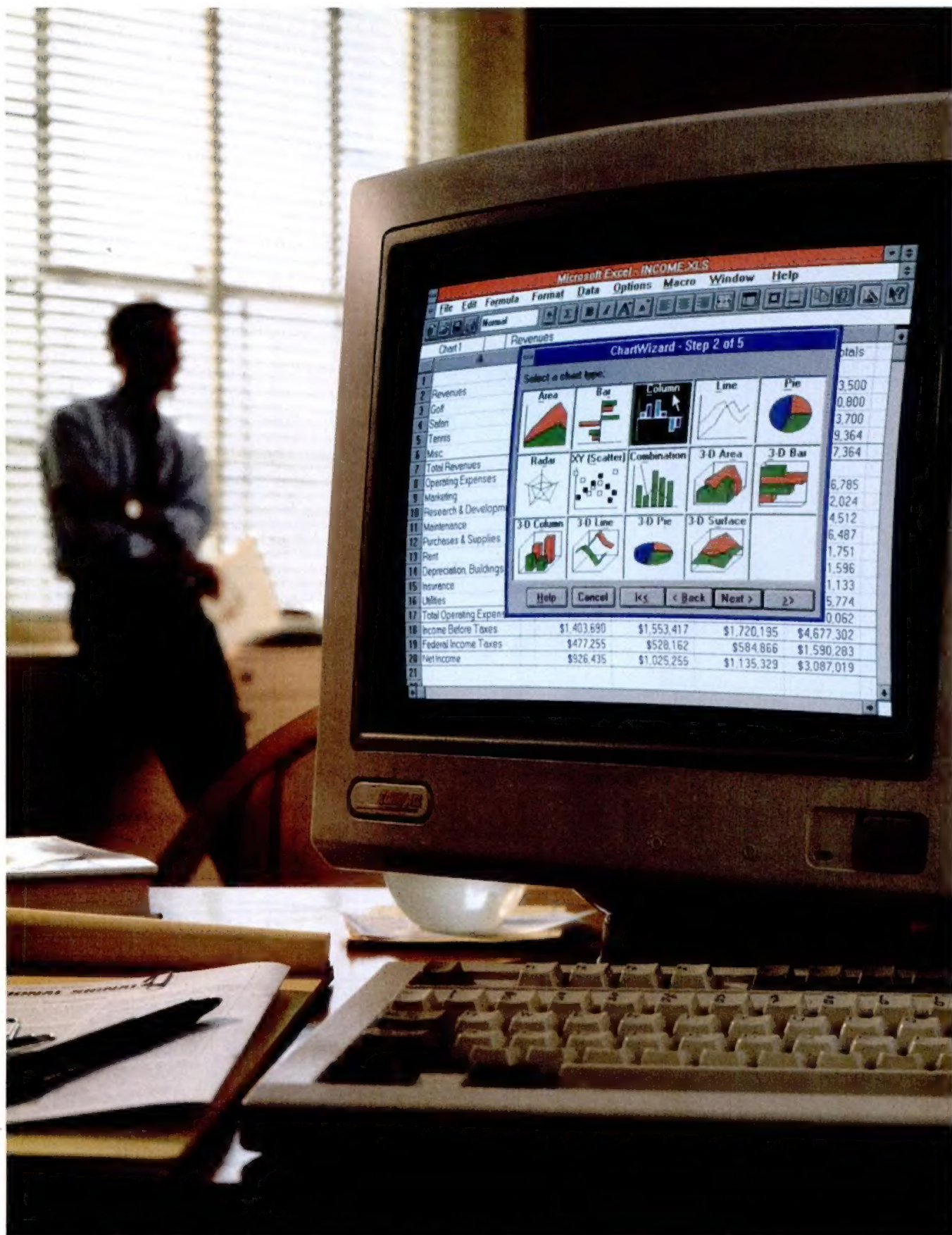
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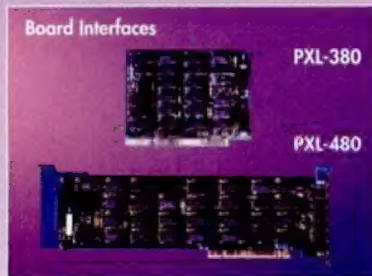
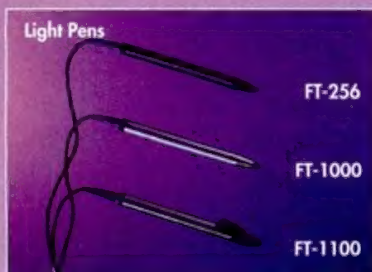
*Each year shows approximate total number of users who have switched. Microsoft Excel 4.0 for Windows has a 90-day money-back guarantee. †Plus freight and applicable sales tax. Offer good through February 28, 1993. For information only: In Canada, call (800) 563-9048; outside the U.S. and Canada, call (206) 936-8661. Microsoft is a registered trademark and Autosum, ChartWizard, and the Microsoft Excel logo are trademarks of Microsoft Corporation.



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Inside

In our first issue of the new year, we return to a ritual that we undergo annually: our selection of the products our editors liked best in the previous year. The process involves a give-and-take that can be every bit as intense and argumentative as our other major

annual ritual, picking our Awards for Technical Excellence.

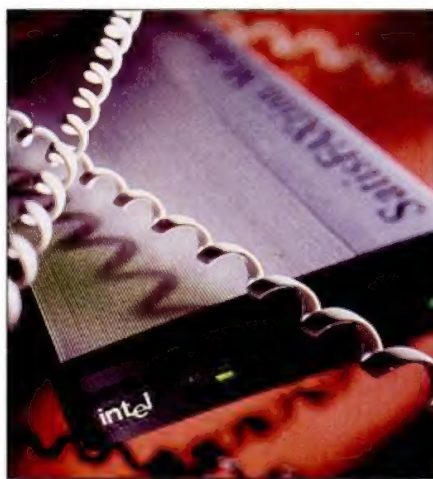
But the Best of the Year is not as formal and structured as Tech Ex or even the Editors' Choice awards that accompany our reviews. Editors' Choice selections involve an elaborate process including scripted lab tests, Suit-

"I *hated* this product," and launch a war of e-mail, lobbying, and argument.

What you have in this issue are the products that survived this not-always-civil discourse. Many of the selections here are not the fastest, easiest-to-use, most versatile, cheapest, most expensive, or most complicated

products in their particular categories. But they had a special something that found champions for them.

The point we're making here is that while it is important to run benchmark tests and to rate products as scientifically as possible, there's an intangible in the relationship between computer products and computer users that is a lot more difficult to measure. But we've all had the experience of using a piece of



One of the best: the Satisfaxion Modem 400/e.

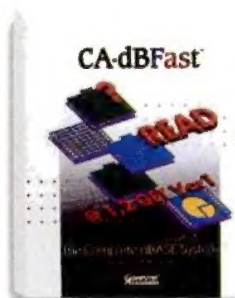
software or hardware and saying, "Gee, that's good!" That experience may seem metaphysical, but it's quite real. For editors who see thousands of common, ordinary products each year, that moment of truth makes up for all those less exciting hours, and earns a product an honored position on our Best of 1992 list.

The 44 products we've rated the Best of 1992 have undergone a far more subjective but no less valid process. One of our editors might say, "I *really* liked this product," and it gets added to the list of candidates. Of course, another editor is just as likely to say,

—Joel Dreyfuss

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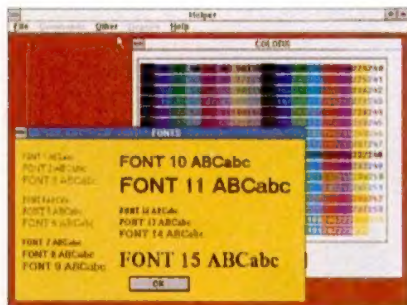


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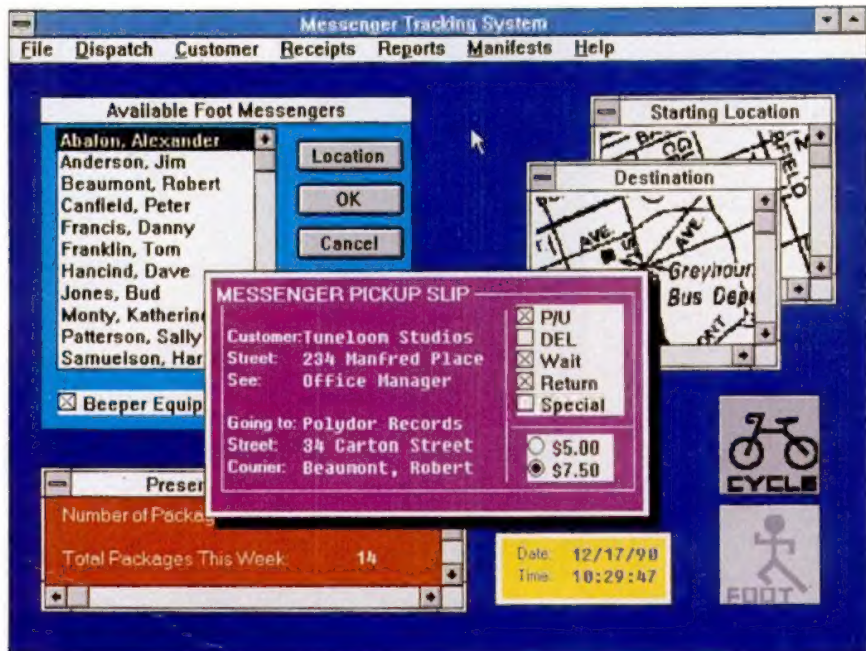


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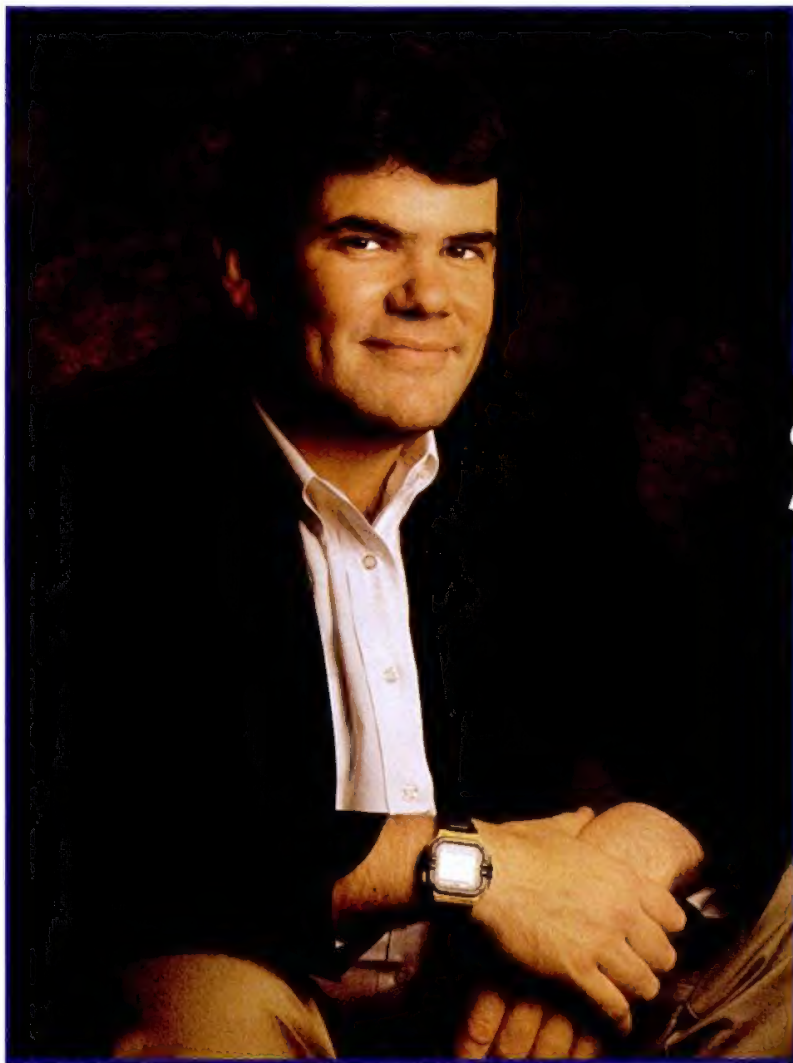
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The Best of 1992

BY JOEL DREYFUSS These are the software, hardware, and peripheral products that stood above the pack in 1992. The ones that made it on this list survived a vigorous, argumentative, not-always-civil debate among our very **opinionated—but well-informed—editors**110

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44 products
surfaced as winners in
our fierce debates
over the year's best
products.

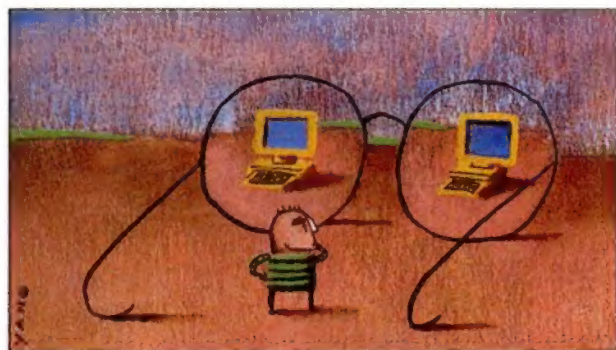


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Making a Choice in an Era of Change

BY ALFRED POOR Whether you're a DOS lover, a CAD professional, or a Windows power user, *PC Magazine's* survey of graphics adapter technology will help you pick the right board.....165

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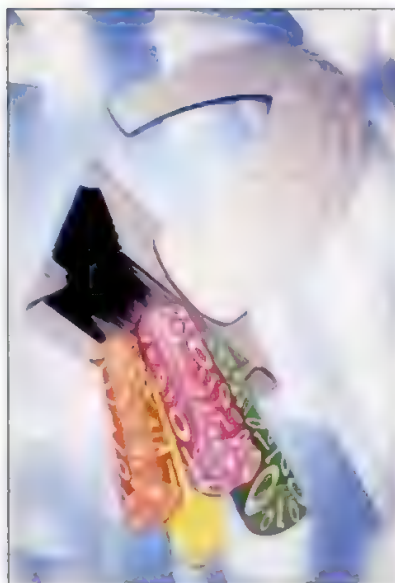
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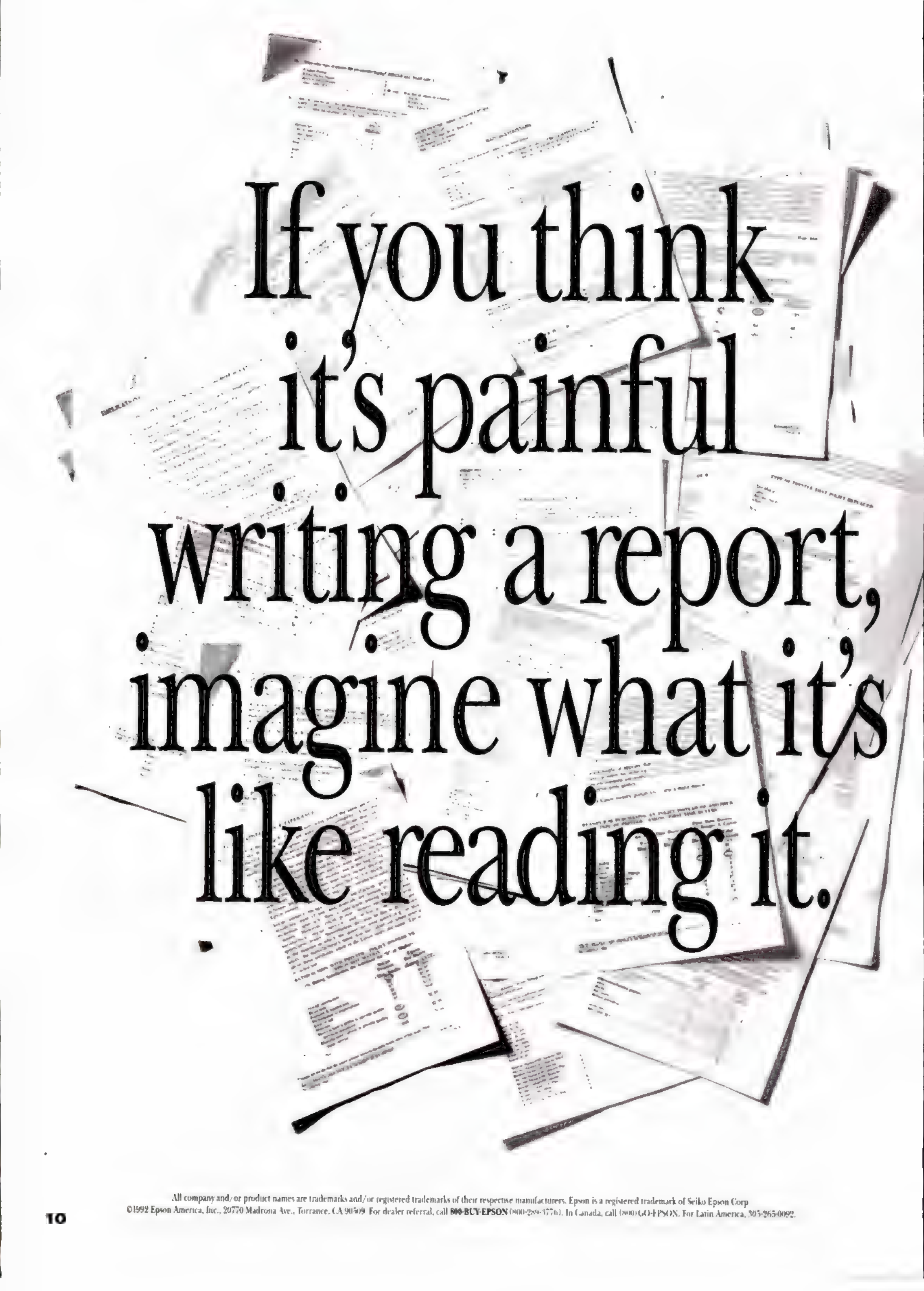
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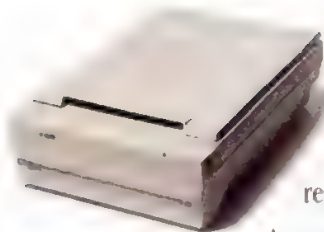
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After Hours:
Zoo Keeper helps
children care about
the animal world
(page 485).





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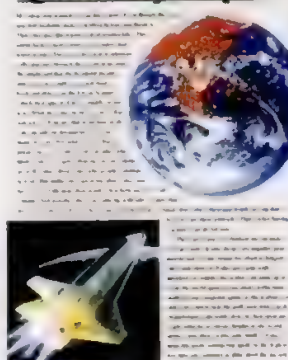
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Except where noted: All *PC Magazine* reviews are of currently available products. Benchmark and performance tests are run on Compaq Deskpro 386/25s and 25e's.

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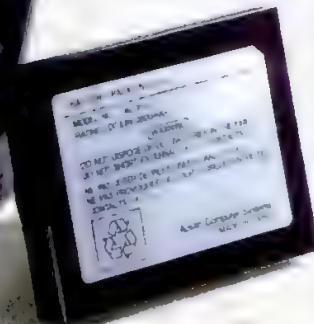


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S/R Fax Modem (9600B Fax/2400B Data)	Yes	No
Battery Life	4 Hours	3.5 Hours
Tech Support	24 Hours/Day	14 Hours/Day
Money-Back Guarantee	60 Days	30 Days
DOS 5.0	Yes	Yes
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PFS Window Works, Contact Manager	Yes	No
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"The Austin 486/33i WinStation packs a lot of performance and expansion into a compact package."

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PC Magazine Contributing Editor Winn L. Rosch

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S



486/SBC-33 WinStation	386/33 WinStation	486/DLC-40 WinStation	486/33LB WinStation	486/DX2-50LB WinStation
Cxrv486SI C, running at 33MHz 2MB RAM to 32MB 80MB Hard Drive 14" VGA 640x480 Color Monitor w/ 256K Video RAM 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1 Mouse Small Footprint Chassis	Intel i386, 33MHz w/ 64K Cache 4MB RAM to 32MB 80MB Hard Drive 14" VGA 640x480 Color Monitor w/ 256K Video RAM 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1 Mouse Small Footprint Chassis	Cxrv486DLC, 40MHz w/ 64K Cache 4MB RAM to 32MB 170MB Hard Drive 14" VGA 640x480 Color Monitor w/ 256K Video RAM 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1 Mouse Small Footprint Chassis	Intel i486, 33MHz w/ 128K Cache 4MB RAM to 32MB 210MB Hard Drive 14" VGA 1024x768 Non- Interlaced Color Monitor Local Bus Video 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1 Mouse Small Footprint Chassis	Intel i486DX2, 50MHz w/ 128K Cache 4MB RAM to 32MB 210MB Hard Drive 14" VGA 1024x768 Non- Interlaced Color Monitor Local Bus Video 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1 Mouse Small Footprint Chassis
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486/50LB WinStation	486/DX2-66LB WinStation	486/DX2-50 EISA WinStation	486/DX2-66 EISA WinTower	386/SXL-25 Notebook
Intel i486 running at 50MHz w/ 128K Cache 4MB RAM to 32MB 210MB Hard Drive 14" VGA 1024x768 Non- Interlaced Color Monitor Local Bus Video 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1 Mouse Small Footprint Chassis	Intel i486DX2 running at 66MHz w/ 128K Cache 8MB RAM to 32MB 210MB Hard Drive 15" VGA 1024x768 Non- Interlaced Color Monitor Local Bus Video 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1 Mouse Small Footprint Chassis	Intel i486DX2 running at 50MHz w/ 128K Cache 8MB RAM to 32MB 340MB HD, EISA/SCSI Cont. 14" VGA 1024x768 Non- Interlaced Color Monitor w/ Windows Accelerator 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1 Mouse Small Footprint Chassis	Intel i486DX2 running at 66MHz w/ 128K Cache 8MB RAM to 32MB 330MB HD, EISA/SCSI Cont. 15" VGA 1024x768 Non- Interlaced Color Monitor w/ Windows Accelerator 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1 Mouse Tower Chassis	386SX running at 25MHz 2MB RAM to 8MB 120MB Hard Drive 9.4" VGA LCD Display, 640x480 w/ 32 gray scale 1.44MB Floppy Drive Built In Track Ball 79-Key Keyboard DOS 5.0 Pre-Installed 6.2 lbs. with battery
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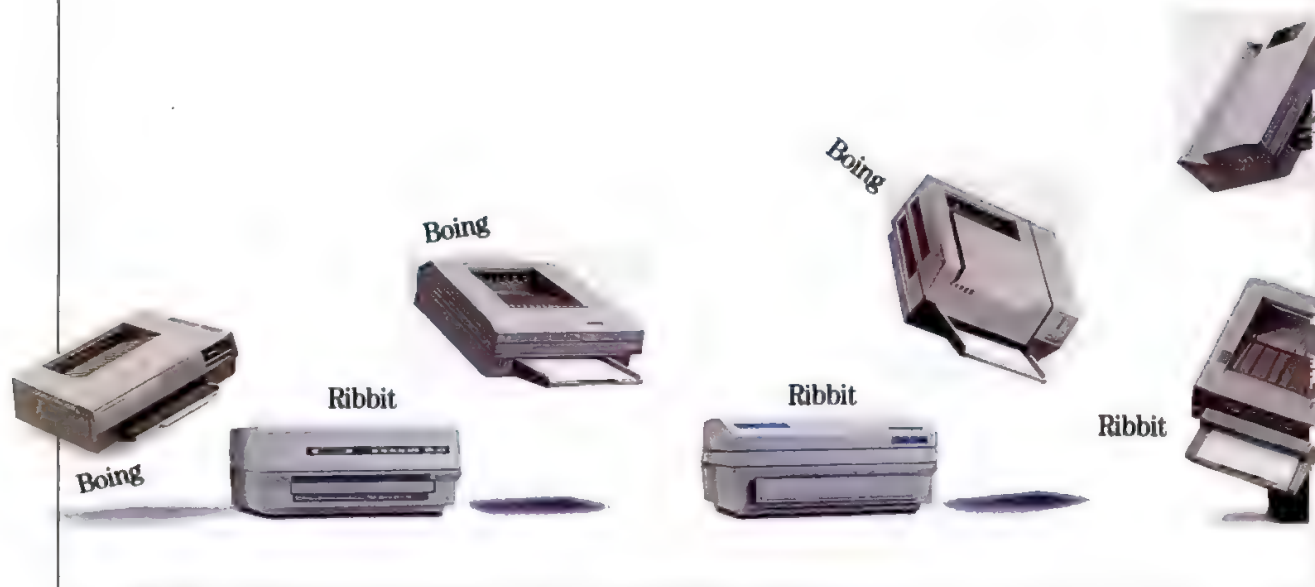
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CIRCLE 012 ON READER SERVICE CARD

PC-AH-3

Other laser printers play leapfrog trying to catch up with the HP LaserJet.

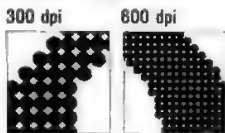


The new HP LaserJet 4 printer isn't a hopped-up version of the past generation. Its new, advanced design sets much higher standards for print quality, speed, built-in features and value than ever before.

Higher resolution. More typefaces.

Unlike other 600 dpi laser printers, the HP LaserJet 4 was designed for 600 dpi printing from the ground up. As a result, it produces the best 600 x 600 dpi resolution ever for noticeably crisper, clearer text and graphics. At less than a 300 dpi price.

Microfine toner and HP's exclusive Resolution Enhancement technology give you razor-sharp edges and much smoother curves.



Four times the dots for better resolution.

With 45 scalable typefaces built into the printer, users can produce a wide variety of documents. Without hassling with downloading or accessory cartridges. Or buying additional typefaces.

More speed, more trays, more flexibility.

Thanks to a new RISC processor, tuned vector graphics and faster I/Os, the HP LaserJet 4 also sets new standards for speed. It even prints many 600 dpi graphics at a true 8 pages per minute. It's faster on networks, too.



With 2 MB of memory built in and new internal memory compression algorithms, virtually all 300 dpi and many 600 dpi documents print from

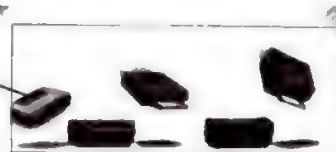
standard memory. Two standard paper trays, with a total capacity of 350 sheets, and an optional 500-sheet tray let users keep printing without constantly reloading different sizes and types of paper. And the optional 75-capacity power envelope feeder saves them from manual feeding. Or dealing with jams.

True 600 dpi creates rich, full-dimensional text and graphics.

Smoother curves, no jagged edges, thanks to Resolution Enhancement.

HP's microfine toner makes 600 dpi output look even sharper and clearer.

45 built-in scalable typefaces let users produce a wide variety of documents.



The HP LaserJet 4 is leaps and bounds ahead of the other laser printers. Our new generation provides superior output with 600 dpi, Resolution Enhancement technology and microfine toner. It also has standard 2 MB memory and new memory management.



Introducing the new HP LaserJet 4 printer. So advanced, there's no catching it.



Mixed environment compatibility. Faster Windows.

The LaserJet 4 is very much at ease with most languages and personal computing platforms. Automatic switching lets it switch between HP's PCL 5 printer language and optional PostScript Level 2 software from Adobe. Hot I/Os allow different hosts to be connected simultaneously.

Optional JetDirect cards provide LAN connections to Ethernet, TokenRing, TCP/IP and LocalTalk/EtherTalk. This makes it easy to plug into just about any network, including PC and Mac LANs. And to get really fast network performance.

To optimize the LaserJet 4 for Windows printing, we codeveloped some breakthroughs with Microsoft.* Including Windows 3.1 TrueType fonts and rasterizer built in to make sure your users

get fast, WYSIWYG printing. The fast Windows driver with HP-GL/2 vector graphics also enhances printing speed.



Several popular software drivers are included: Windows, WordPerfect and Lotus. As well as the new HP Explorer PC utility software, which provides a printing tutorial to guide your users through set-up and operation of the printer's new features.

All this makes the HP LaserJet 4 printer supremely simple to plug-and-play. As you'd expect, it also offers complete document and software compatibility with the HP LaserJet III printer.

Setting the standard in price, too. With all these advances and more, you'd expect a big jump in price. Quite the opposite. At just \$2,199,*

the HP LaserJet 4 printer lists for less than the printer it replaces. And, of course, it comes with pace-setting HP quality and reliability.

Call 1-800-LASERJET (1-800-527-3753), Ext. 7133 for the name of your nearest authorized HP LaserJet dealer†. And ask for a print sample to see just how great the output looks.**

**If it isn't a LaserJet,
it's only a laser printer.**



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*Suggested U.S. list price. †In Canada call 1-800-387-3867, Ext. 7133. **To have a LaserJet 4 printer data sheet sent immediately to you via fax machine, call 1-800-964-1492 from your touch tone phone. Microsoft is a U.S. registered trademark of Microsoft Corp. Windows 3.1 is a product of Microsoft Corp. Adobe and PostScript are trademarks of Adobe Systems Incorporated which may be registered in certain jurisdictions. Lotus is a U.S. registered trademark of Lotus Development Corporation.

According to Mr. Magoo, there's no trick to spotting a reliable monitor. You just pick one from a manufacturer that has met the stringent ISO 9000 series of standards for quality. And displays the ISO 9000 seal. The way Samtron does.

In fact, Samtron was awarded ISO's highest rating: ISO 9001. One of the very few monitor manufacturers in the world to ever earn it.

To achieve that rating, we underwent 1½ grueling years of auditing ordered by the Geneva-based International Organization for Standards (ISO). Everything we do was scrutinized. From design and manufacturing through packing and shipping.

Their high rating means that, with the possible exception of advertising, they approve of what Samtron does. The way we train our people. The way we keep our records. Our management. Our delivery. Our overall product quality. About the only thing they weren't quite sure of was Magoo.

Gads, Two New Flat-Screen Monitors.

With our world-class ISO credentials clutched in hand, we present our new high resolution flat-screen, color monitors. The SC-528DX multi-mode 15" And the SC-726V, our 17" with 0.26 dot pitch. These monitors have pictures so big and so sharp that even Mr. Magoo's eyes can see them. All the way out to the corners. Without distortion. Which makes them ideal for viewing Windows™ or CAD/CAM. If your needs are smaller look at our

14" EagleEye™ color monitor SC-428TX. With 0.28 dot pitch and 1024 x 768 non-interlaced resolution.

They're all monitors worth looking into.

Even Mr. Magoo can see that.

Now, Even Reliability Is Easy To See



Model SC-726V
17" Flat-Screen Color Monitor
0.26 Dot Pitch
1024 x 768 Non-Interlaced Resolution
Full Screen Color
Full Screen Graphics
Full Screen Text
Full Screen Video
Full Screen Audio
Full Screen Data
Full Screen Control

Along with our ISO 9001 rating, Samtron's reputation for reliability is what Mr. Magoo sees. It's the only monitor technology that's been approved by the ISO 9001 standard.

WE'RE WORTH WATCHING

SAMTRON

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CIRCLE 296 ON READER SERVICE CARD

Letters

USEFUL UTILITIES

Thank you for your fine article "The Best Utilities: Essential Tools" (October 13, 1992). I have only moderate experience with software, so I depend on your product reviews a great deal. They have helped me make sound buying decisions many times. In the case of this article, for instance, I have already chosen two packages to buy based on your coverage of them.

David Dowdy
Modesto, California

I read with great interest "The Best Utilities: Essential Tools" and found the information useful. Since you included Michael J. Mefford's CO/DirMatch/DR/RN collection, you should know about Directory Freedom (DF) written by Gordon Haff.

DF is absolutely outstanding. It's even better and more useful than CO or DR. Without a doubt, DF is definitely my greatest shareware find since List some years ago.

Bruce M. Bowman
Ann Arbor, Michigan

THE SECRET BEHIND THE SCREENS

After reading Michael J. Miller's column "Secret Screens, Part II" (October 27, 1992), I've found that reactions to these screens range from welcome amusement to hatred for the RAM they occupy.

What people don't seem to realize is that these secret screens serve a very practical purpose: They are for copyright lawsuits. It is entirely possible that two companies could develop almost identical source codes. It would be impossible to prove that one company copied the other's—unless you put in a section of code so unique that duplication could not be the result of accident. For this reason, software developers put "neat" little tricks into their software. Back in the DOS days, it was songs. In Windows, it's graphics.

Until the world is safe from people stealing others' ideas, there will be secret screens.

R.D. Flores
Pismo Beach, California



*I read "Best Utilities"
with great interest and
found useful tools.*

CALERA CLEAR-UP

I would like to set the record straight with regard to your article, "Fax OCR Gets Better and Faster" (Trends, November 10, 1992).

For clarification, Calera Recognition Systems is in the business of providing superior OCR software and systems, not developing fax hardware. I would also like to point out that our product, FAX-Grabber, has always been able to recognize faxes sent in standard mode, with good results.

Calera will soon be announcing a major breakthrough in the technology of its core OCR engine, which will further improve the accuracy on degraded documents, especially faxes.

Daniel Mueb
V.P. Marketing
Calera Recognition Systems
Sunnyvale, California

INTERNET IS A REALITY

As I read your article "E-Mail Systems: Can They Keep Their Customers Satisfied?" (October 27, 1992), I noticed one piece of vital information that was missing about all of the packages: Could any of them send or receive mail from the Internet?

PC Magazine must understand Inter-

net and worldwide e-mail are realities. Please give us the necessary information on the tools to access and use these capabilities.

Michael A. Chance
St. Louis, Missouri

GIVING CREDIT WHERE CREDIT IS DUE

In a sidebar to "E-Mail Systems: Can They Keep Their Customers Satisfied?" you say, "Now, smart forms can also be network smart. PerFORM Pro from Delrina Technology can be used to develop forms that are used to route e-mail messages."

The first sentence is true, forms messages can now be mailed using Lotus cc:Mail or Microsoft Mail. Unfortunately, you seem to be confused about which forms product is mail-enabled. Though Delrina has announced plans for this sort of capability, its current shipping product is not mail-enabled. JetForm is currently the only mail-enabled forms product available.

Barry H. Gillespie
JetForm Corp.
Ottawa, Ontario, Canada

FANTASTIC!

Just a note to thank you for publishing "Typecasting: Choosing and Using Fonts" (October 27, 1992). I haven't slept for the last three days, reading and re-reading your excellent article. Even though you had a very complex subject to cover, its depth and breadth were clear and cohesive. I've learned a great deal and have been making many telephone calls to the various sources that you provided. Thanks again for one of the best articles I've ever read on the subject.

Alfred R. Lubienski
Grosse Pointe, Michigan

COMMUNICATIONS COMMENT

In the section on DOS versus Windows asynchronous communications, "DOS Lives" (October 13, 1992), you stated that Windows greatest strength is its ability to perform communications tasks in the background. You go on to say, however, that Windows is unable to do these tasks at very high speeds.

Only an AST engineer
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PowerExec in ways previously only seen in desktops. We call it Intelligent Power Management, and it's just one of the break-

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*1958 Harley Davidson
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V-Twin with swingarm frame.
Optional, of course*



LETTERS

Obviously, you haven't heard about Telcor Systems' new T/PORT add-on card. By simply plugging this card into your computer and replacing the Windows async communications driver with the one Telcor provides, Windows will reliably handle background communications of up to 115 kilobits per second.

Michael J. Aarons
Natick, Massachusetts

IT'S JUST A GAME!

A message to game-writers out there: We appreciate the efforts you go through to create dazzling special effects. It is ridiculous, however, to expect us to reconfigure our entire systems just to play a game.

The last three games I have played require up to 600K of free RAM. Come on, guys, most systems out here have less than 600K free! I think it's reasonable to expect any software package to be able to run in 512K.

Ron Peoples
La Vista, Nevada

ENCORE, ENCORE!

I was happy to see your article on MIDI software (After Hours, October 27, 1992). Your discussion of Encore failed to note, however, that the program will not display properly on anything other than a "plain vanilla" VGA monitor.

It can be very frustrating to buy products that receive no bad marks, only to find that they won't run on my computer. I think even small reviews should note some of these limitations.

Wayne Erfling
Miramar, Florida

CORRECTIONS AND AMPLIFICATIONS

SURGE SUPPRESSOR RETEST

Because of an error in ZD Labs' testing procedures, *PC Magazine* published inaccurate performance test results in our review of surge suppressors, "Power Protectors: Surge Suppressors Clamp Down on Spikes" (September 29, 1992). ZD Labs corrected the error in its testing setup and re-conducted the Pass-through Voltage test for all 30 surge suppressors included in that review. We publish the new results here.

As in the first tests, we based our analyses of the second set of results on our determination that a typical PC power supply can handle, unaided, around 800 volts; we chose 500 volts of pass-through voltage as a safe margin, and one indicating satisfactory performance from the surge suppressors. On our previous tests, only 4 of the 30 products consistently passed through no more than 500 volts on surges of 2,000V, 4,000V, and 6,000V intensities. The results of the retest now show that all but 7 of the products we tested provide this level of protection for spikes of all three intensities. (Lower scores represent increased surge suppression capability and better performance.)

As on the previous tests, two units suffered a complete failure of suppression circuitry at surges of 6,000V intensity: the Power Sentry Surge Protector 300 Plus Model 106 and the Woods Wire Products 5623 Surge Suppressor. Before they failed, however, both units did provide audible or visual alarms

that indicated that surge suppression would no longer be active at this level; when we disregarded the alarm and sent through the 6,000V spikes, both surge suppressors let the energy through.

We had awarded Editors' Choices to two products in the September 29 issue,

but based on our retesting, we now believe that no product stands out significantly. Therefore, we have rescinded the Editors' Choices that we previously awarded. Given that the majority of these products provide satisfactory performance, we at *PC Magazine* believe that you can base your buying decisions on product features and price, which ranged from \$12.95 to \$399.

Also, we inaccurately reported the name of the unit supplied by American Power Conversion; the correct name is the Surge Arrest Plus with Tel. We also reported that this product uses only fuses to protect the phone line, when it actually uses MOVs, a more effective technique. Last, the EFi Electronics PowerTrax 2000 does include inductors in its design. *PC Magazine* will examine power protection products again in early 1993.

PASS-THROUGH VOLTAGE

Pass-through voltage	Surge severity level		
	2,000V	4,000V	6,000V
AESI/ StediWatt Diagnostic Power Refinery, Model 718	430	521	592
American Power Conversion Surge Arrest Plus with Tel	344	341	341
Brooks Electronics Surge Reactor BN6-6	166	164	149
Brooks Power Systems Surge Stopper BPS-BN6-6	373	402	441
Control Concepts Supertrac ST6D	338	387	398
Current Technology Power Siftor Pro 15	348	351	337
Curtis Manufacturing Ruby Plus	345	377	437
Data Shield S100	334	340	345
EFi Electronics PowerTrax 2000	316	312	326
Electripak 6SSU	493	625	685
GC Electronics Power Management System 64-631	373	412	468
Geist Ultimate SRF-6MO/S	336	361	371
General Semiconductor Industries 1206K6	307	316	323
Inland 3 Mode Surge Protector	430	484	544
Innovative Technology SPIU-6	251	264	254
Jayco Electronics Suppress-All AC-6	306	325	331
Joslyn Electronics Systems Model 1203-03 Surge Suppressor	355	355	362
Kensington Microware Power Tree 50	370	402	417
L.E.A. Dynatech CS-615	341	344	343
NCR Pyramid	281	275	291
Pacific Electriccord XP	391	458	519
Panamax Max 6	326	338	369
Pass & Seymour/ Legrand C6-L	394	422	439
Perma Power RS610	441	616	685
Power Sentry Surge Protector 300 Plus Model 106	406	472	Fail
Proxima ProLine 30	322	357	410
SL Weber Surge Sentry DL6D	331	355	390
Tripp Lite Isobar 8	331	348	346
Woods Wire Products 5623 Surge Suppressor	398	480	Fail
Zero Surge ZS1800 Surge Eliminator	137	128	150

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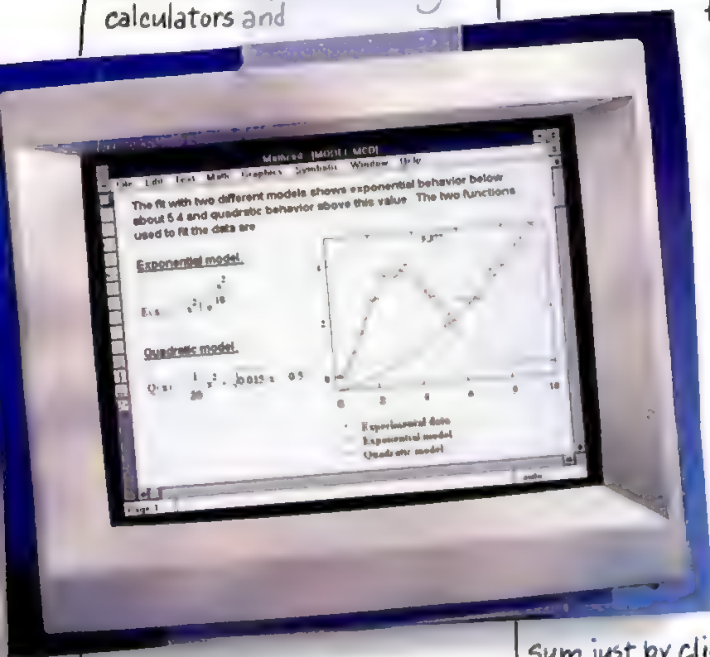
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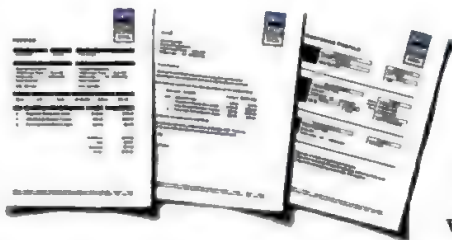


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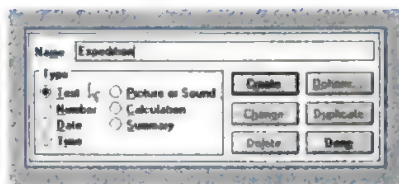


And Windows User Magazine dubbed FileMaker Pro "an excellent program that anybody can use."

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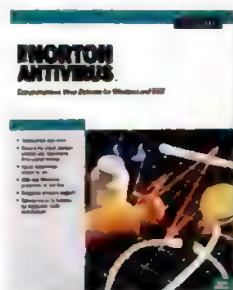
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CIRCLE 344 ON READER SERVICE CARD

DOS 6 to Double Hard Disks

Microsoft hopes to repeat DOS 5 success.

Imagine a software package that doubles the size of your hard disk, gives your applications lots more RAM, and protects your data with a handful of basic utilities for less than \$100. Sounds too good to be true? Microsoft is betting it sounds good enough to buy. It

hopes the combination of built-in compression and memory optimization will make MS-DOS 6 every bit as popular as MS-DOS 5 has become.

In PC software history, the success of DOS 5 is second only to Windows 3.1. But Microsoft hasn't always been so adept at getting its operating system customers to upgrade, and not every DOS upgrade has fared so well in the marketplace. MS-DOS 4.01 flopped when it debuted in November of 1988. Microsoft blamed IBM's buggy 4.0 release for the weak reception, but when it came right down to it, users just didn't find DOS 4's new features—a shell interface, expanded-memory device drivers, and support for large hard disk partitions—enticing enough to bother upgrading. The experience taught Microsoft some valuable lessons about what it takes to make an upgrade succeed: compelling features, exhaustive testing, and retail availability are the keys, the company concluded.

By its June 1991 introduction, MS-DOS 5 had been tested by 7,500 users,

more than any other software package to date. With it, Microsoft made a version of DOS available through the retail channel for the first time. And most importantly, MS-DOS 5 included memory management that was so much better than earlier flavors of DOS that users felt they had to have it.

Now Microsoft is using the same strategy with MS-DOS 6. The company has already launched an extensive beta test program: Starting in August 1992 with just 2,000 users, the number will grow to 10,000 by the product's release later this winter. And the upgrade will be available as a retail package for under \$100.

Compression may be the most compelling new feature in MS-DOS 6. The growing popularity of products such as PKZip/PKUnzip, Stacker, and SuperStor indicates that users are increasingly less worried about losing data through compression. Info-Corp estimates that only one percent of the installed base uses compression today, but it expects that number to grow significantly. Among power users, compression is

Continues on page 32

MS-DOS Evolution

- MS-DOS 6**
Winter 1993
Compression, memory optimization, utilities
- ⋮
- MS-DOS 5**
June 1991
Memory management, utilities
- ⋮
- MS-DOS 4.01**
November 1988
Large hard disks, expanded memory, shell interface
- ⋮
- MS-DOS 3.3**
April 1987
Multiple partitions on hard disks
- ⋮
- MS-DOS 3.1**
March 1985
Microsoft networks
- ⋮
- MS-DOS 3.0**
August 1984
12MB floppy disks
- ⋮
- MS-DOS 2.0**
March 1983
Hierarchical files and hard disks
- ⋮
- MS-DOS 1.0**
August 1981
DOS debuts on IBM PC

Source: Microsoft Corp

Sizing Up Laptop Batteries

DURACELL HOPES TO DO FOR LAPTOP computers what it did for "point-and-shoot" cameras: develop standard sizes (both in watts and form factor) for rechargeable nickel hydride battery packs.

Standard battery packs would relieve portable PC manufacturers from having to custom-design their own rechargeable batteries, according to Robert O'Keefe, Duracell's strategic marketing manager. That should yield savings in both production time and costs.

Duracell claims that its nickel hydride battery packs will provide up to 40 percent longer performance than today's ubiquitous nickel cadmium batteries. Nickel hydride batteries are also better for the environment than nickel cadmium batteries because they use very little cadmium (a nonbiodegradable toxic metal). Duracell's nickel hydride batteries will also have fast-charge capabilities and will be compatible with nickel cadmium chargers.

Due by the end of 1993, the battery packs are expected to come in five to ten standard sizes. Duracell points out that consumers are accustomed to five alkaline battery types for everything from flashlights to portable CD audio players. The company predicts that eventually laptops, cellular telephones, and camcorders will all share the same battery pack.—*Tin Albano*

Video for Windows Spawns Hardware

TO PLAY "MOVIES" WITH MICROSOFT's new Video for Windows (VFW) program, you won't have to buy any special hardware. But to make your own movies, you'll need to get a video capture board. Until now, video capture boards were primarily the domain of professional producers or niche market applications, but VFW's easy-to-use capture and edit tools are helping to spawn some rather interesting and affordable new products.

The third-party boards, which range from

Trends

\$400 to \$1,300, work with VFW to record and add your own images, and in some cases stretch the image so it's reasonably displayed full-screen. While all such boards will capture video, there's a chasm of difference when it comes to resolution, speed, and compression.

In the next few months we'll see a variety of capture boards that offer various features. Some of the video boards will simply capture the data stream and save it to disk in VFW's .AVI file format. Others will use a hardware assist to compress the files.

Capture boards allow you to increase the frame rate, which is the number of frames per second (fps) from 15, the minimum, to 30, which makes for smooth real-time video—although even the best demos

we've seen don't look as good as TV.

At \$349, Media Vision's Pro Movie Spectrum is one of the least expensive capture boards available. It will capture video at the minimum 15 fps rate and display it in the small 160-by-120 resolution window. It uses

a proprietary compression algorithm in its codec (the driver that compresses and decompresses the video clip), which it licensed to Microsoft.

SuperMac Technology's VideoSpigot for Windows costs \$499 and can display 15 fps in a 320-by-240 window,

or 30 fps in a 160-by-120 window. VideoSpigot uses its proprietary codec, called Compact Video.

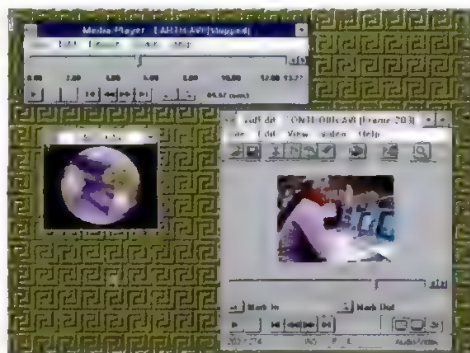
In the VFW box, Microsoft is shipping drivers for Creative Labs' \$499 Video

Blaster, a frame grabber that will let it capture sequential frames using the VidCap utility at 15 fps. Also in the box are VFW drivers for New Media Graphics' Super VideoWindows board. At \$895, it will capture video at 15 fps in a 160-by-120 window, and it has stereo audio capabilities on the same card.

Moving up in features is IEV International's \$995 ProMotion Multimedia Engine. Claiming a frame rate of over 20 fps, ProMotion supports a variety of frame sizes and screen resolutions up to 1,024-by-768.

At the high end of the spectrum is Intel's \$1,295 RT Video Developers Kit. Using the proprietary Indeo video codec and a hardware coprocessor to compress the images, Intel claims that the files can be played back at 30 fps in a 320-by-240 frame. Using the Indeo video codec and no hardware assistance, Intel promises a playback rate of 24 fps on a 33-MHz 486, and 15 fps on a 33-MHz 386.

Start saving your money. If you care about image quality, we think you'll want the faster frame rates.—*Christopher Barr*



Microsoft's \$199 Video for Windows.

Pipeline By Robin Raskin

For the Good of the Group?

A whole generation of now-comfortable computer users is about to revisit computer paranoia. The catalyst is groupware. Regardless of which group solution you standardize on, one thing is certain. Groupware forces you to give up a chunk of your autonomous personal workstyle for the good of the group. Part of the challenge will be to figure out what groupware means to your organization. For now, groupware is one of those "I know it when I see it" terms, like pornography or multimedia.

The term will fade fast as real groupware applications—schedulers, routing programs, forms packages, and innovative e-mail solutions—become part of our workaday lives. These dyed-in-the-wool groupware activities will be quickly followed by every possible form of creative collaboration—word processing, spreadsheets, CAD—and yes, the compound document, with snippets from every application in the software universe. Adding to the confusion, operating systems will begin to claim traditional groupware application functionality.

Three of the most interesting contenders for a group solution are Lotus Notes, Word Perfect Office, and Microsoft Windows for Workgroups.

The granddaddy of groupware applications, Lotus Notes, is scheduled for a major release, Version 3.0, in early 1993. The price of a Notes solution has dropped from astronomical to just plain expensive. Increasingly positioned by Lotus as an *environment*, Notes' key strength has always been its database, which can be replicated across WANs and LANs so that the content remains current. Notes' e-mail capabilities are present, but not as strong as they should be; right now, Notes' mail

won't even work with Lotus's own cc:Mail without a special gateway. The Notes database is a programmable chameleon: You build the system you need based on top of this database/e-mail backbone, which has been faulted for being a rigid, inflexible interface. The new version will add Macintosh support (with Unix to come), full text-search capabilities, and better e-mail integration.

Word Perfect Office got an early reputation for being the economy-minded workgroup solution, but Version 4.0, scheduled for release in early 1993, ups the ante. It combines attractive e-mail, calendaring, and scheduling, plus it's the only solution that's got the cross-platform part of the equation. DOS, Windows, and Mac versions will be available simultaneously, followed by OS/2, Unix and VAX/VMS. The new version's strengths include workgroup-centric procedures such as rules-based messaging and "delegation," which lets you route an action item.

Microsoft's response to workgroup computing is its characteristic refrain: Put it in the operating system. Windows for Workgroups ships with e-mail and scheduling apps and allows for Dynamic Data Exchange (DDE) across the network. But the most interesting aspect will be applications that take advantage of Windows' newfound shared directories, scheduling, and e-mail prowess. You may be able to route a CAD drawing through a list of revisions, pull it into a Word for Windows document, and ship it off with a video- and sound-enhanced e-mail message, all without leaving your base application. Because it is an environment-based approach, Windows for Workgroups may be one of the most far-reaching solutions.

Right now you can't mix and match the best of breed in each of these systems very easily. Groupware's gonna be great, but it may take some tough groupware therapy encounters first.



PHOTOGRAPH BY PETER GREGOIRE

Robin Raskin is an executive editor of PC Magazine.

Top Retail Software

Current ranking	Last issue	Product/company
1	3	WordPerfect 5.1 for Windows WordPerfect Corp.
2	—	Quicken for Windows 2.0 Intuit
3	5	Microsoft Windows 3.1 Microsoft Corp.
4	8	QEMM-386 6.0 Quarterdeck Office Systems
5	10	Microsoft Windows 3.1 Upgrade Microsoft Corp.
6	7	Microsoft DOS 5.0 Upgrade Kit Microsoft Corp.
7	—	Office for Windows 3.0 Microsoft Corp.
8	4	PC Tools 8.0 Central Point Software
9	2	Quicken 6.0 Intuit
10	1	TurboTax ChipSoft
11	—	Microsoft Windows for Work-Groups 3.1 Microsoft Corp.
12	—	Microsoft Excel for Windows 4.0 Upgrade Microsoft Corp.
13	14	LapLink Pro 4.0 Traveling Software
14	—	Microsoft Money for Windows 2.0 Microsoft Corp.
15	15	Microsoft Excel for Windows 4.0 Microsoft Corp.

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending October 31, 1992. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market. Sales information compiled by Ingram-Micro.

LAN Packages Distribute Apps

WHEN NETWORK USERS NEED THE latest version of an application, the system administrator usually can't just purchase the package, copy it to the server, and post an announcement. Someone has to install the program for each user on the network, and that can turn into a time-consuming headache. Luckily, a number of vendors are introducing automated solutions for custom-installing applications (including upgrading and notifying users of upgrades) on multiple PCs.

Novell, IBM, Frye Computer Systems,

and Software Spectrum have recently announced software distribution programs, and Microsoft also has one in the works. Although mainframe-based software distribution has been around awhile, the new crop of programs brings this function to PC servers.

Novell's Network Navigator is actually a downsized version of Annatek Systems' mainframe program, inherited when Novell acquired Annatek last summer. The program performs unattended distribution, tracks updates in a log file, notifies users, and lets you undo installation if there's a problem. Navigator's list price starts at \$1,000 for five nodes.

Software reseller Software Spectrum is using Network Navigator as the LAN basis of its Diamond product. Priced on a usage-fee basis, Diamond adds features such as correlating distribution with site licenses, generating purchase orders and invoices, informing you of vendor discount options, custom installation scripting, and iconizing Windows applications (214-840-6600).

Another contender is Frye Computer Systems' Software Update and Distribution System (SUDS). Priced at \$495, SUDS provides features such as configuration management for users' WIN.INI and CONFIG.SYS files and multiple-server support for wide-area networks, along with scheduling, notification, and undo capabilities (617-451-5400).

IBM's solution, based on its CID (Configuration, Installation, and Distribution) architecture, is built into several products, including IBM LANfocus Start/2 (\$595), NetView Distribution Manager/2 (\$1,495 per server, \$95 per client PC), and Network Transport Services/2 (\$85). CID allows distribution of OS/2 software, and by mid-1993, IBM plans to support DOS and Windows users as well. IBM is also working with many software vendors, including Lotus and WordPerfect, on CID-enabling their applications.

The LAN Support Group plans to ship software distribution modules for its BindView NCS product by the first quarter of 1993 (800-749-8439).

Touchstone Software Corp.'s new bulletin board service (\$29.95 annual fee) provides information on product upgrades for customers of its CheckList software inventory manager. In the future, Touchstone plans to add software distribution services to CheckList (800-531-0450).

Finally, not to be outdone, Microsoft is at work on a software distribution program as part of its Hermes project, a set of systems management tools it plans to release soon after Windows NT.—Michael Cohn

Earth to EO, Earth to EO

EO INC. RECENTLY TOOK THE wraps off the first of a new class of battery-based computers called Personal Communicators. Like a mobile communications command post, Personal Communicators will combine fax, cellular modems and phones, pagers, e-mail, and a computer. Powered by AT&T's Hobbit chip and designed for person-to-person communications, EO's first two machines will be available next spring.



\$1,999 EO
Personal Communicator 440.

Weighing a scant kilogram (2.2 pounds) and measuring 10.8 by 7.1 by 0.9 inches (LWH), the mixed-voltage \$1,999 EO Personal Communicator 440 operates on GO's PenPoint in ROM, and comes with a number of applications in ROM. It has a pen interface and a reflective LCD, with a PCMCIA socket, a port for a PS/2 keyboard, and parallel and serial ports. It contains a built-in microphone and speaker. The basic unit can be enhanced with several options, such as an internal V.32bis fax/modem, a cellular telephone handset, and Hewlett-Packard's Kittyhawk 1.3-inch 20MB hard disk.

The beefier 880, at 13 by 9 by 1.1 inches and 4 pounds, has a backlit LCD, comes standard with a modem and two PCMCIA sockets, and operates at 5 volts. The 880 also has an external VGA connector and a SCSI port. An optional 64MB internal hard disk is available for \$700. The 880 is priced beginning at \$2,999.

EO may be the first to ship a communications-oriented subnotebook, but General Magic and Hewlett-Packard are rumored to have competing products in the works.

—Christopher Barr

Protecting Your E-mail Privacy

UNTIL LAST SUMMER, MOST PC USERS probably didn't worry much about the privacy of their electronic mail. But then they read about Eugene Wang. The Borland vice president of languages defected to the competition, Symantec, and the next thing he knew, Borland executives were perusing his MCI mail messages to Symantec CEO Gordon Eubanks for trade secret violations. Borland CEO Philippe Kahn cried foul, and the cops were knocking at the doors of both Wang's and Eubanks' homes. Borland has since pressed civil charges, a criminal investigation has been launched, and Symantec has decided to avoid further controversy by not assigning Wang to its languages group.

For employees, the most important lesson to learn from Wang's nightmare is that your e-mail privacy is not guaranteed. For employers, the key is to develop and distrib-

ute a clear e-mail policy to employees.

The Electronic Communications Privacy Act (ECPA) of 1986 protects the privacy of users on public e-mail systems (like MCI mail, where the communication between Wang and Eubanks took place), but Michael Cavanagh, executive director of the Electronic Mail Association (EMA), points out that the ECPA isn't specific enough in defining who the sender is when the account is owned by the employer and used in the workplace. Two bills being considered—the Simon Bill in the Senate and the Williams

Bill in Congress—to restrict monitoring of telephone business could be interpreted to apply to electronic mail, but to date, there is no legislation that protects an e-mail user's right to privacy in the workplace.

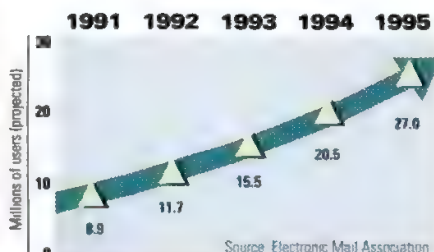
Lance Rose, a New York City attorney, reports that it is

the employer, not the employee, who has most of the rights in the workplace. Mark Gordon, a Chicago attorney, says that although employees may have an expectation of privacy, there is no *guaranteed* right at any level. For more information on the legal aspects, you can read Rose's *SysLaw*, a \$35 le-

gal guide for on-line service providers published by the PC Information Group (800-321-8285).

The EMA publishes a \$45 booklet to help companies establish e-mail privacy policies (703-875-8620). Other sources include *Privacy Times*, a biweekly newsletter publication (\$250, one-year subscription, 202-829-3660), and *Privacy In Computer Networks*, a paper written by Jeffrey S. Kingston and Gregory L. Lippetz (Brobeck, Phleger & Harrison, Attorneys At Law; 415-328-5555).—Daniel A. Begun

E-Mail Mania



As e-mail use rises, so will concerns about how private it is.

MS-DOS 6

CONTINUED FROM PAGE 29

already well established: In a recent PC Magnet survey, nearly 70 percent of the 1,139 respondents said they use at least one compression product.

Like the standalone compression products, MS-DOS 6 uses an algorithm based on the Lempel-Ziv technique that gets rid of redundancy by *tokenizing* recurring data patterns. The MS-DOS 6 algorithm should double the capacity of most hard disks.

"Memory management sold MS-DOS 5," says MS-DOS 6 product manager Richard Freedman, "and users asked us to make it even better." In DOS 6, a full-blown optimizer automatically sets up memory. The optimizer isn't just easier to use, it's also more powerful. Freedman says most users can expect it to free up approximately 150-200K of RAM for applications, compared with roughly 100K with MS-DOS 5. For any user, that's a lot, and for many it will be enough. But power users will still want to buy add-on products to get such advanced features as Quarterdeck's Stealth mode, which lets TSRs take advantage of the memory areas usually used by the ROM BIOS.

In case the two big features of the new version don't win you over, Microsoft

Compression



Nearly 70 percent of the 1,139 PC Magnet survey respondents said they use compression.

has hedged its bets by integrating some basic utilities into the package, most of which are subsets of popular programs. DOS 6 includes backup (real backup, this time), virus protection, undelete (enhanced), and file transfer. But utilities developers need not fear: MS-DOS 6 will still leave power users hungry for more advanced features.

—Mary Kathleen Flynn

Briefs

TO ENCOURAGE PC USER GROUPS TO

continue to contribute to their communities, the Association of Personal Computer User Groups (APCUG) and Ziff-Davis Publishing Co. (which publishes *PC Magazine*) have established the first annual Recognizing Exceptional Achievement in Community Help (REACH) Awards. Winners will receive \$15,000 to continue their efforts in five categories: education and training, civic and cultural affairs, environment and conservation, medicine and health, and social welfare and improvement. Nominations are due February 1, 1993. (Write the APCUG at 1730 M. St. N.W., Suite 700, Washington, D.C. 20036.)

BY 1995, CPUs WILL RUN AROUND 250

MHz and have a 32-64K built-in cache, predicted representatives from chip makers Intel and Cyrix at the fall

Microprocessor Forum. And, they said, CPUs will still run DOS. Mighty fast.

TRYING TO WOO WALL STREET, MICRO-

soft has formed two councils and one alliance in the financial services industry. Both councils will develop extensions to the Windows Open Services Architecture (WOSA), Microsoft's framework for providing services to Windows apps. The Banking Systems Vendor Council is developing the WOSA Extensions for Financial Services, a set of APIs for retail banking. The Windows Open Market Data Council is creating WOSA Extensions for Real-Time Market Data, a set of APIs for giving Windows apps access to real-time market data. Solutions for Commercial Banking is a Windows-based environment for commercial banking functions being developed by Microsoft, Andersen Consulting, Banca, and Micro/Resources.—Mary Kathleen Flynn

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First Looks

HANDS-ON EVALUATIONS OF THE NEWEST SHIPPING PRODUCTS

■ Graphics

Visio: Intelligent Tools for Informative Drawings

BY LUISA SIMONE

Even if you've only dabbled in vector-based graphics, you're probably familiar with the differences between desktop publishing programs, drawing programs, and data-driven charting programs. Visio, a \$299 Microsoft Windows-based graphics product from ShapeWare Corp., stakes out new territory by targeting a different kind of drawing—diagrammatic or informational drawing.

Diagrams convey information by the use of symbols as well as by the spatial relationships between symbols. Therefore, an organization chart reveals reporting structures based upon the size and position of name labels. Decision trees, flow charts, network topologies, maps, and floor plans are also nothing more than diagrams of

information and processes.

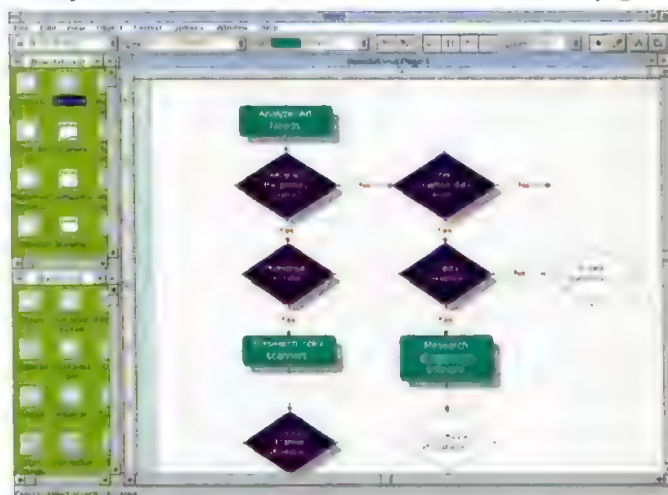
Visio lets you create all of these diagrams—and many more—with its drag-and-drop ease. It ships with hundreds of symbols that are stored in a special file called a stencil. To create a drawing you simply select a shape from one of the 16 stencils and drag it over to your document window. The master objects stored in a stencil often exhibit intelligence or specialized behavior.

For example, when you draw lines between the labels in an organization chart to show reporting relationships, Visio glues the lines to the shapes. As a result, the connecting lines stick to the respective shapes even when you move or realign the elements in a drawing.

Ease of use is the guiding principle behind Visio's drawing tools. The program offers a host of helpful hints and accessible

tools. To add text to a shape in Visio, all you have to do is select the object and start typing, because every Visio object serves double duty as a text label. Likewise, the program gives you constant feedback in the form of color coding. You'll always know if a connector line is properly glued to a shape because glued points appear in red and

• *Continues on page 40*



SMART STENCILS: Drag-and-drop to create a Visio flowchart.

■ Programming Languages

Visual Basic Overhaul Eases Windows Programming

BY BARRY SIMON

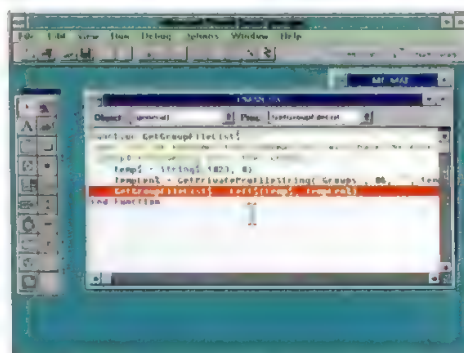
Eighteen months ago, Microsoft revolutionized Windows programming with Visual Basic for Windows, Version 1.0, an environment that combined event-driven programming and a visual route to user interface design.

With the release of Version 2.0, Microsoft has addressed shortcomings and enhanced the already attractive product: Program execution is faster,

the program editor is improved, the interface is more flexible, some lower-level aspects of

Windows are now accessible, and debugging is better.

Like many development packages, VBWin 2.0 comes in a Standard Edition (\$199) for occasional programmers and a Professional Edition (\$495) for full-time coders.



NEW: VBWin's button bar and color coding.

IMPROVED INTERFACE

The basic paradigm behind VBWin 2.0 is unchanged. First, you draw controls on your program's windows, called *forms*. Then you write code to describe the events that can happen to a form or its controls—a click on a command button, for example.

In design mode, there

• *Continues on page 42*

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Full-Motion Video

Microsoft Goes Hollywood With Video for Windows

BY JOHN R. QUAIN

An old saw in the PC business says that the capabilities of software always lag behind the capabilities of hardware. Microsoft Video for Windows (\$199) may be the first major exception: a software tool waiting for the hardware to catch up.

Unlike video expansion boards that convert standard analog television transmissions for display on VGA monitors, Video for Windows is a digital video software-only package that allows Windows 3.1 users to store, play back, and edit compressed, digitized motion video clips on a hard disk or from a CD-ROM player.

On 386 and 486 ISA-based PCs, Video for Windows will play video in a 160- by 120-pixel window (about 1.5 by 2 inches) at 15 frames per second (fps). Without additional hardware support, Video for Windows' video is jumpy and grainy, so it still falls short of television's 30-fps full-motion video. However, the software technology is scalable and can benefit substantially from additional hardware support. The program also includes a video capture utility, but it requires additional third-party hardware such as a video capture board and camcorder.

Although Video for Windows' basic utilities don't rise to a level sophisticated enough for extravagant multimedia presentations, its tools provide a foundation and a de facto standard for bringing motion video to the PC world. If you need to, you can use Video for Windows to add video clips to e-mail, insert segments into training and educational applications, or embed captured video in OLE-compliant spreadsheets and documents.

Offering a common file format (.AVI), media control interface (MCI), and support for several codecs (compression/decompression algorithms), Video for Windows is an integral addition to the multimedia capabilities of Windows 3.1.

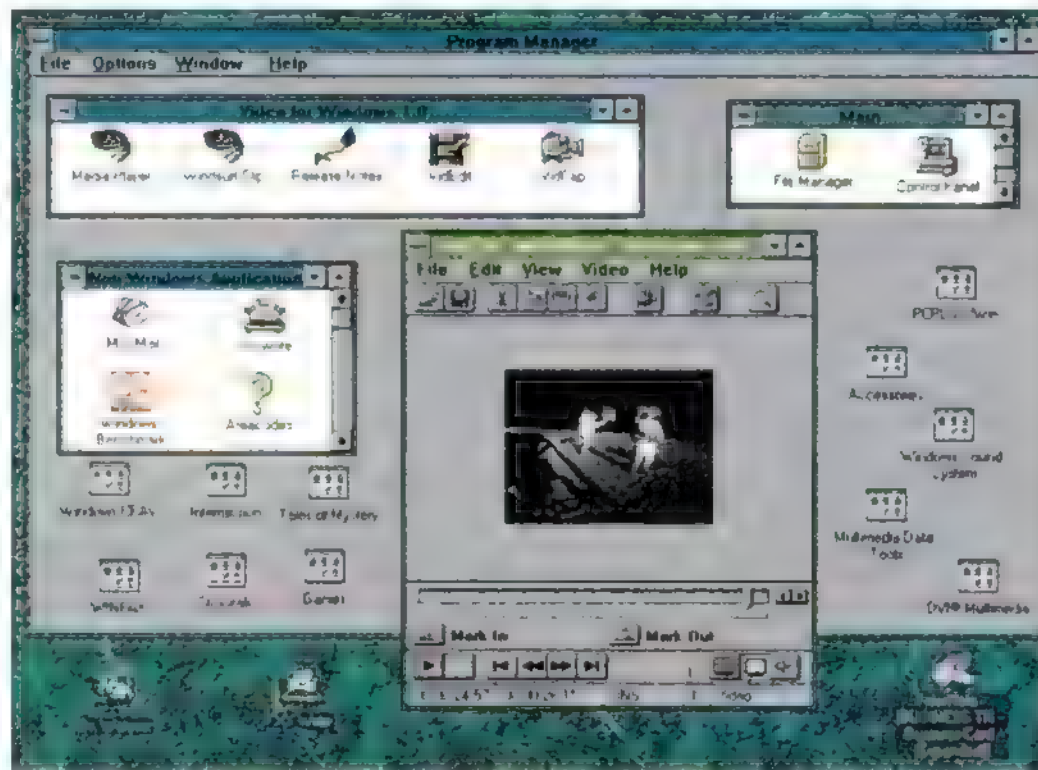
The software is based on Microsoft's AVI (audio video interleave) file format, which allows playback of files with .AVI extensions that contain motion video and audio. The images and sound are synchronized within .AVI files, so that the files play back as minimovies. AVI also allows a variety of codecs to be used for storing video and audio data.

THE UTILITIES

For playing back these .AVI minimovies, Video for Windows adds a new Media Player to

tus Development Corp.'s Ami Pro 3.0 and Microsoft's Word for Windows 2.0b. Embedded video clips can also be set to play within a document without visibly launching the player. In the package, Microsoft includes a CD-ROM disk containing over 200 sample clips.

The Video for Windows group also includes simple editing tools. VidEdit enables you to perform basic cut and insert editing functions similar to those found on home VCRs. Users can easily mark insertion and deletion points on a video clip with the click of a mouse or edit the .WAV audio track separately. VidEdit doesn't provide quite the precision and control that is needed for complex editing, but most users will find it easy to use and sufficient for most applications.



AT THE MOVIES: Play clips in a 160- by 120-pixel window.

Windows 3.1. The new version adds OLE (Object Linking and Embedding). The Media Player acts as an OLE server so that video clips can be pasted into and played back from OLE-compliant applications. Inserting clips is straightforward, and it worked well in tests using Lo-

VidEdit also lets you change the compression rate and quality level. Thus you can make finer adjustments on the video and audio interleaving, depending on whether you're playing back the material from a CD-ROM player or hard disk.

Microsoft's VidCap utility is

a motion video capture program that can be used only in conjunction with special hardware. Our tests were conducted using Intel's Action Media II board, which can accept and capture an analog video signal from a camcorder, VCR, or laserdisk player.

The equipment is not inexpensive. The ActionMedia II board is \$1,395 and requires an additional \$495 module to capture video in real time. A camcorder will typically cost another \$600 to \$800, so a complete setup can easily cost you over \$2,500.

To digitize and store your minimovies, VidCap lets you select the video source and set the color depth, number of frames per second, frequency of key frames, and size of the captured images. VidCap also allows you to select the audio sampling size (8- or 16-bit), channels (stereo or mono), and sample rate (44.1 kHz, 22.05 kHz, or 11.025 kHz) as well as to set the volume input levels. Using the Action Media II board, we were able to capture motion video in 24-bit color at 30 fps in real time.

Capturing your own video clips demands an immense amount of storage space, however. Depending on the amount of motion (and thus the amount of information) in the clip, a 10-second 16-bit color video made at 15 fps with 8-bit mono audio recording can take up 2MB of disk storage—after it's been compressed.

A compressed 1-minute-15-second clip of a car race in 8-bit color at 15 fps with 8-bit sound can require over 11MB of storage space. So don't plan on storing *2001: A Space Odyssey* on your 200MB hard disk anytime soon.

COMPRESSION DEPRESSION

A full installation of the Video for Windows package takes about 3.1MB of hard disk space. During installation, it automatically scales video playback in accordance with the performance of your PC. It tests CPU utilization and the video subsystem by

First Looks

comparing bitmapped-image transfer rates to pixel transfer rates.

In some systems we tested, when the pixel throughput was higher than the bitmap transfer rate, the program warned us that we might "encounter display performance problems." We were still able to play .AVI video clips on these systems, and according to Microsoft, the message is intended to prompt users to acquire updated software drivers from the adapter vendors. After performing this diagnostic, the software automatically sets the optimal frame-per-second rate for motion video on your system.

Most 386 and 486 PCs can accommodate the 160- by 120-pixel playback window with acceptable performance. However, if you enlarge the frame beyond this tiny size, the image becomes distorted and halting. The audio can also skip and break up. This occurs because the codecs supplied with Video for Windows automatically drop video frames when the data throughput demands exceed the capabilities of the PC.

Hardware codec accelerators, such as the Action Media board, can solve this problem, but don't expect smooth images without such an investment.

HARDWARE-DEPENDENT

The seamlessness of the motion, detail of the image, and size of the video window depend directly upon hardware. In a 16-MHz 386 ISA-based machine (lacking special hardware), acceptable video quality can be achieved in a standard 160- by 120-pixel window at 15 fps, though the image will be slightly fuzzy and spasmodic.

In hands-on tests, we found that to play video on a full screen at 30 fps in 24-bit color, a 50-MHz or 66-MHz 486DX2-based PC was necessary, and it needed a fast SCSI hard disk, local-bus video accelerator, and hardware to accelerate the decompression of the video.

Additional factors may affect Video for Windows' perfor-

mance on your system. The amount of data traffic across the bus, the quality of your VGA adapter's software drivers, and the throughput of your hard disk (or CD-ROM drive) can all influence performance.

Data compression also reduces the quality of the motion video and prevents it from looking like full-motion film or television. In order to store and transmit the information within PCs, current codecs (called *lossy* methods) attempt to eliminate redundant information to reduce the storage requirements, often sacrificing image detail in the process.

Video for Windows includes support for three different codecs. The program automatically recognizes and plays back .AVI files compressed using either Intel's Indeo, Microsoft's RLE (run length encoding), or Microsoft's Video 1 format. All three codecs are scalable, which means you can adjust the size and frame rate of video playback—within limits. All three codecs also are able to work without special hardware in playback mode.

FACT FILE

Microsoft Video for Windows, Version 1.0

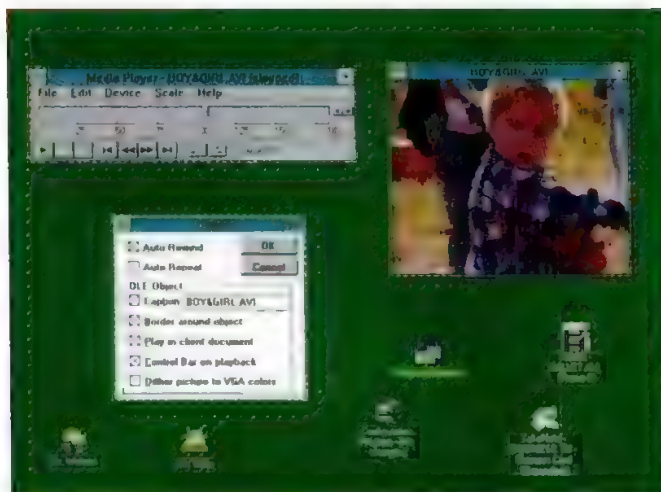
Microsoft Corp., One
Microsoft Way, Redmond,
WA 98052; 800-227-4679,
206-882-8080

List price: \$199.

Requires: 386-based PC or better with 4MB RAM, 100MB hard disk (3.1MB hard disk space for application), VGA adapter, DOS 5.0, Microsoft Windows 3.1. **Optional:** CD-ROM drive for sample disk playback, video capture board for video recording, sound card for audio playback.

In short: Video for Windows brings full-motion video to the desktop so that you can insert video clips into OLE-compliant applications without any special hardware. Video quality suffices when the clip is kept in a small window, but extra hardware is needed to capture clips or to play them back well at larger sizes.

426 ON READER SERVICE CARD



OLE SERVER: You can drop clips into other applications.

The highest video quality we achieved employed Intel's Action Media II board and Indeo codec (the card currently accelerates only Indeo compressed files). Indeo is scalable up to a 24-bit color depth at 30 fps. To expand the screen sizes, Intel's codec interpolates data; that is, it judges the difference between keyframes and adds needed information to smooth out the image. With the Action Media II, we were able to play back a 640-by-480 window in 24-bit color at 30 fps and capture it in real time.

Microsoft's Video 1 codec is similar but is limited to 8-bit or 16-bit color and cannot capture video in real time. On a 33-MHz 486, acceptable video quality is constrained to a 160- by 120-pixel window at 15 fps, but a hardware assist can produce smooth 24-fps playback in a 320-by-240 window, according to Microsoft. (Currently, several companies have announced hardware support for the Video 1 codec, but no products were available for testing.)

The shortcoming of RLE is that it provides less compression than the other two and is limited to 8-bit color, but its advantage is in capturing bar charts and graphs for presentations, where it delivers sharper outlines on letters. The other two codecs tend to produce images that look fuzzy along straight lines.

In spite of its limitations,

Video for Windows is a promising product. Microsoft's .AVI file format, along with MCI, allows third parties to add their own codecs and hardware accelerators to this foundation, so you can expect to see a proliferation of associated peripherals and software soon.

Several hardware and software companies have already announced supporting products, though not all solutions will support all codecs. Media Vision's \$349 Pro MovieSpectrum (510-770-8600), SuperMac Technology's \$499 VideoSpigot for Windows (408-245-2202), and Creative Labs' new version of its Video Blaster (which will support JPEG compression band is expected to cost about \$600; 408-428-6600) are just a few of the boards already announced.

With street prices already at around \$150, Video for Windows is reasonably priced and comparable to rival Apple's QuickTime. Unfortunately, Microsoft's promised QuickTime compatibility is not included in this version of Video for Windows, though a Mac-based conversion tool is included. (The company expects full QuickTime compatibility to be included in the next release.) But with QuickTime or without, Microsoft Video for Windows brings true full-motion video a significant step closer to your desktop. □

Visio

CONTINUED FROM PAGE 37

unglued points appear in green.

Visio's drawing tools are so straightforward that they are only capable of producing simple shapes, such as a rectangle, an ellipse, a circular arc, and straight lines. To create more complex objects you can add shapes together, subtract shapes from one another, or use one shape to cut another shape into smaller pieces. These deceptively simple commands allow even inexperienced users to edit complex vector outlines. More importantly, they let you avoid the sometimes difficult concepts of node editing and Bezier curves that are typically associated with high-end illustration programs like CorelDRAW and Adobe Illustrator.

EASY, FAST EDITING

Regardless of whether you drag a shape from a stencil or create a shape from scratch, it's a snap to change its appearance with Visio's formatting functions. Visio's sophisticated type style options are similar to those found in DTP programs and include character, paragraph, and tab formats. Special text options, such as vertical alignment, allow you to center text blocks within a shape in order to create professional-looking labels.

Many of Visio's formatting functions are intended to help you produce consistent-looking documents. Master Styles allows you to alter the text attributes, line style, color, and fill pattern of an object in one fell swoop. However, Visio's emphasis on consistency also limits the program's capabilities. If you want your drawings to contain a wide range of colors, gradient fills, or varying line weights, you'll find it impossible to produce

FACT FILE

Visio, Version 1.0

ShapeWare Corp., 1601 5th Ave., #800, Seattle, WA 98101-1625; 800-446-3335

List price: \$299.

Requires: 4MB RAM, Microsoft Windows 3.1.

In short: Visio is a new kind of drawing program—one that provides specialized tools to create diagrams and informational images. The program's unique templates and stencils let even novice users create drawings with drag-and-drop ease, while the ShapeSheet gives power users the ability to analyze and modify the geometry and behavior of master objects.

427 ON READER SERVICE CARD

them with Visio's internal tools. The program supports only five predefined line weights and has a palette of only 24 colors.

The palette colors are mapped to the objects in your drawing, so when you change a color in the palette all of the objects formatted with that color are automatically updated. On the up side: objects created within Visio are always consistently colored. On the down-

side: if you want to exceed Visio's limit of 24 colors per document, you must import pictures (in standard file formats such as CGM, TIFF, BMP, or WMF) from other graphics programs.

Strictly speaking, Visio has very little competition. Only one other product on the market, Aldus Intellidraw, boasts the same smart drawing functions offered by Visio. Though the two programs are identically priced, there are important functional and philosophic differences. Broadly stated: Aldus Intellidraw offers more sophisticated tools, but Visio gives you more control over

the shapes that it creates.

For example, Intellidraw contains a dedicated tool that lets you create properly scaled bidirectional dimension lines, so if you edit the displayed numerical value it will actually change the length of the line.

In contrast, Visio requires you to take an ordinary line and insert a data field. This approach seems less powerful because it is not bidirectional—you can't change the length of a line by changing the value displayed in the data field. But Visio's use of fields means that you can display a variety of information—assigned model numbers, the current page number, or even information based on a customized formula.

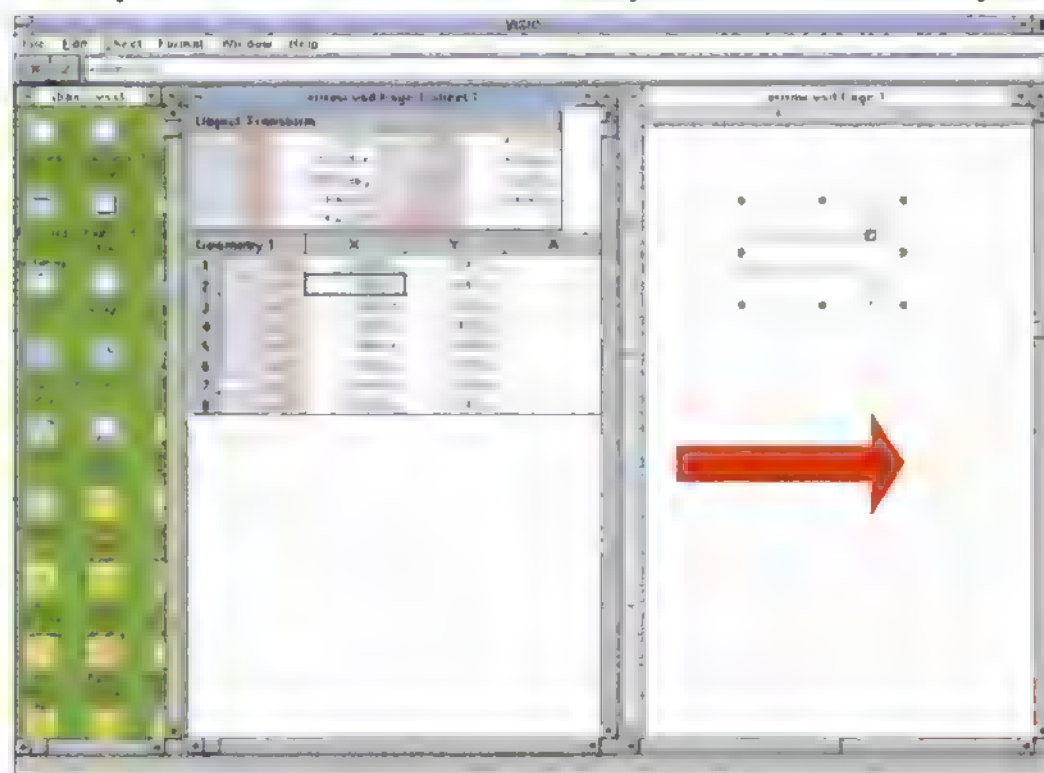
SMART SHAPES

Ultimately, Visio shines because it lets power users create their

uses a spreadsheet metaphor, allows you to define an object's geometry using *x* and *y* coordinates, offset values, formulas, and even cell references.

Only the most ambitious users will want to access Visio's ShapeSheets. In fact, the Visio user manual avoids any lengthy discussion of ShapeSheet. But it's likely that professional designers, MIS specialists, and third-party developers will use the ShapeSheet to create customized vertical-market stencils. ShapeWare is spearheading this movement by offering 16 additional stencils that range in price from \$49 to \$79 and in subject matter from kitchen planning to chemical engineering.

Broadly speaking, Visio competes with a range of programs that are not necessarily defined as graphics products. Many users are frustrated by the



SHAPESHEET: The geometry and behavior of objects in Visio are determined by the values stored in a ShapeSheet.

own smart shapes. On the simplest level, you can determine how the individual objects in a group will behave when the group is resized. You can also lock aspects of a shape's geometry such as width, height, or angle of rotation. If you lock the aspect ratio of an object, changing the shape's height will automatically and proportionately change the object's width.

If you want total control over an object's behavior, you can plunge into a special editing window called the ShapeSheet. It

fill-in-the-blank approach of dedicated organization charting programs, the steep learning curves of CAD programs, and the data overhead of full-blown project management programs. Visio provides a refreshing change by letting you draw organization charts, floor plans, and Gantt-like schedules directly. Best of all, the program's smart shapes and drag-and-drop approach to document creation make it possible to forget about the drawing tools and concentrate on the information. □



To download a working demo of Visio from PC MagNet, type GO ZNT:DEMOS from any CompuServe prompt. From January 4 through January 8, you can go on-line to discuss Visio with Luisa Simone and Visio development manager Peter Mullen. Type GO ZNT:EXEC.

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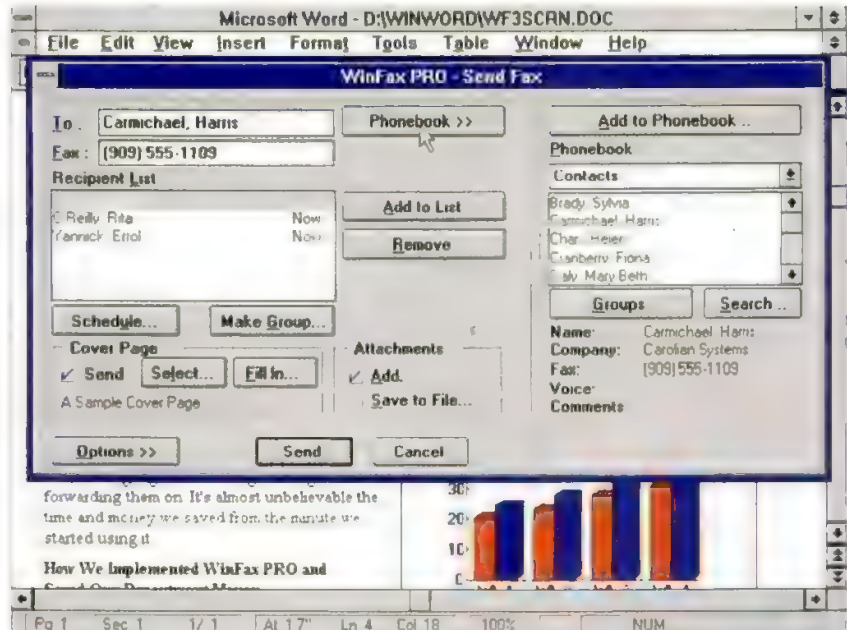
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Visual Basic

CONTINUED FROM PAGE 37

is a floating toolbox of controls, 20 in the Standard Edition, 5 more than in Version 1.0. The new OLE client and Grid controls, borrowed from Version 1.0's Professional Toolkit, include new graphics controls—line, shape, and image.

A significant change in the interface is the replacement of a properties bar by a window. Version 1.0 had a bar with a drop-down list of the properties each control could have, such as colors, fonts, and displayed text. These could be set using the properties bar or during run-time. The control whose properties were displayed had to be picked with the mouse.

VBWin 2.0 has replaced all that with a two-column window that lets you see much more information and choose controls from a drop-down list.

Another improvement: You can select several controls, see their common properties, and change all of them at once. This lets you align several controls or change fonts in one step.

The interface now has the kind of button bar that has be-

come a Microsoft standard. There are buttons for creating new projects and modules, for opening and saving projects, and for accessing menu design tools, the properties window, and debugging controls.

IMPROVED CODING ENVIRONMENT

Microsoft has improved the way you deal with code by adding several features to the code editor, most notably a multilevel undo and color coding so that keywords, variables, and remarks have distinct colors. A welcome enhancement is the ability to pop up a list of procedures and jump to any one in any module.

Another code-level advance lets you optionally save all the code and form information in ASCII format. This slows down initial loading of the code but lets you use version control and code maintenance utilities that would choke on the binary format used in Version 1.0.

On the language level, the most important addition is the Option Explicit directive, which forces a module to predeclare all variables. This prevents the kind of spelling error bugs that plagued the earlier version of Microsoft Basic. Debugging has also been significantly improved (see "Better Debugging").

A new data type called Variant can change from a number to a string from one statement to the next. It follows the freewheeling and unstructured BASIC tradition that may make the structured programmer uncomfortable.

This version also gives you more access to application internals. For example, you can control the order in which windows and controls appear front-to-back on screen (the "z-order").

VBWin 2.0 is compatible with Version 1.0 except for a few new keywords. We ported the MC utility that appeared last year in *PC Magazine* and only had to remove definitions of true and false (they're now built

■ Better Debugging

The debugging tools in Visual Basic for Windows, Version 1.0, were primitive. There was a single step mode, and you could break by using absolute breakpoints, an explicit STOP command, or by hitting Ctrl-Break. Once at a break, you could examine variables by typing PRINT statements into an intermediate window. There were no automated watch variables and no conditional breakpoints.

VBWin 2.0 has brought debugging to the level we expect in a modern programming environment. You can highlight a word in code and add it to the watch list. Watched variables can be displayed at the time of a break or can be used to set conditional breakpoints. At a break you can get a list of "pending calls"—procedures which have started but haven't run to completion.

But Microsoft has gone beyond merely playing catch-up by putting the debugging in a visual framework through VBWin 2.0's button bar. There is a set of three buttons that look like VCR controls. They can be used to start, break or stop a program. To the right is a set of buttons to set a breakpoint, insert watches, access the call list, or single step or trace a procedure. Debugging is never fun, but this new user interface sure makes it easier.—BS

in) and change a variable called Count, now a keyword.

MDI DONE RIGHT

The multiple document interface (MDI) is a Windows standard by which subwindows can be iconized and cascaded. The MDI control in the Version 1.0 Professional Toolkit was awkward. This version of Visual Basic gets it right.

Each program can have a single, specially designated MDI

parent. Adding children during program runtime is achieved with a simple ReDim statement. You can even add a window menu to the parent form that lists all the children.

PROFESSIONAL EDITION

The Professional Edition includes 16 controls from the Version 1.0 Professional Toolkit plus six new controls. The old common dialog and new masked edit controls are so fundamental they should have been included with the Standard Edition.

The new controls include a comm port reader and two MAPI controls for making e-mail-aware applications. The Professional Edition has ODBC support for database connectivity, and includes a Windows 3.1 Help compiler, a Windows 3.1 API help file, and a database of technical support questions and answers.

Visual Basic for Windows, Version 2.0, is such a substantial upgrade that any current owner will want it, and it makes the product more attractive to new users as well. □

FACT FILE

Microsoft Visual Basic for Windows, Version 2.0

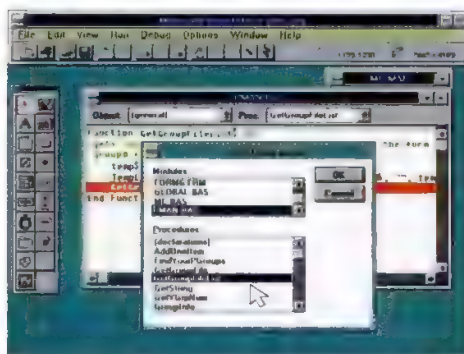
Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080; fax, 206-936-7329

List price: Standard Edition, \$199; Professional Edition, \$495; Standard Edition upgrade, \$79; Professional Edition upgrade, \$99; Standard to Professional upgrade, \$199.

Requires: 1MB RAM, 14MB hard disk space (for full installation of Professional Edition); Microsoft Windows 3.0 or later.

In short: VBWin Version 1.0 programmers will want to get this upgrade. It has improvements in all areas, from the speed of the generated code to color-coded editing and better debugging.

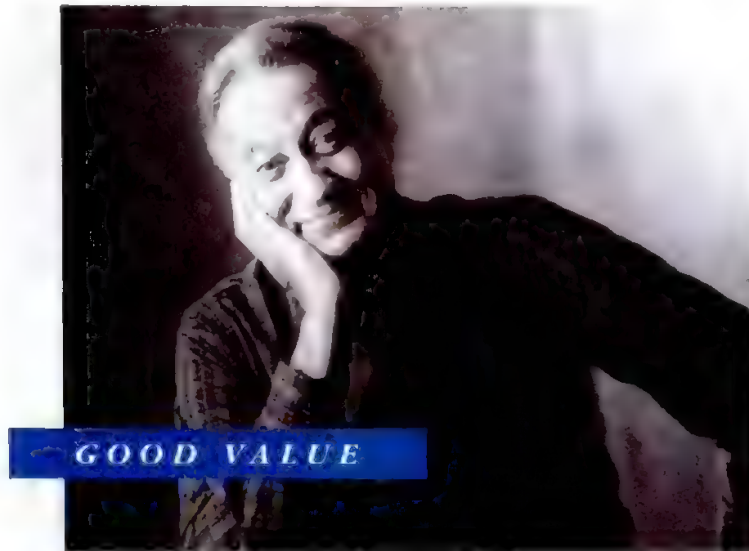
ON READER SERVICE CARD



INFORMATION, PLEASE: VBWin now pops up project procedures groups by module.

parent form, and other forms can have the MDI child property set to true. Take these two simple actions, and VBWin automatically handles windowing, keeping MDI children inside the

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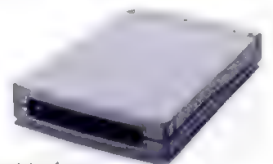
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■ Programming Languages

Borland Pascal 7.0: Fast, Complete

BY NEIL L. RUBENKING

The key concept behind the \$495 Borland Pascal 7.0 is *independence*. It's this independence that a programmer working in either DOS or Windows needs in order to develop applications for DOS real mode, DOS protected mode, or Windows.

A combined upgrade to Turbo Pascal and Turbo Pascal for Windows, BP7 has a built-in DOS extender that pulverizes the 640K barrier and a new protected-mode IDE (Integrated Development Environment) that compiles even the largest DOS programs. DOS-based BP7 programs can now call on Windows-style DLLs (Dynamic Link Libraries), and BP7 programmers can write "computation engine" DLLs that work unchanged in Windows or DOS protected mode.

The package includes an abundance of programming support tools: Turbo Debugger, Turbo Profiler, Resource Workshop, Turbo Assembler, WinSight and WinSpector, two application frameworks, 4MB of online help, and the complete run-time library source code.

Borland's Turbo Pascal programs remain entry-level products. The new TP7 incorporates all the language enhancements, optimizations, and new IDE tools of BP7. TP7 features the immense capacity of a protected-mode IDE but can only create real-mode programs.

BEYOND THE 640K BARRIER

The big news is BP7's ability to generate DOS protected-mode programs. Programmers can bypass the 640K barrier for code or data without paying royalties for a separate DOS extender.

We took a simple program that reads text into a linked list

and recompiled it for protected mode. With no other changes, the program successfully loaded a 100,000-line text file that occupied 2MB of memory. The familiar New and GetMem routines allocate memory via DPMI (DOS Protected Mode Interface) functions using a heap sub-allocation system. Code segments are discardable by default, so a BP7 protected-mode program functions as if each unit were an overlay.

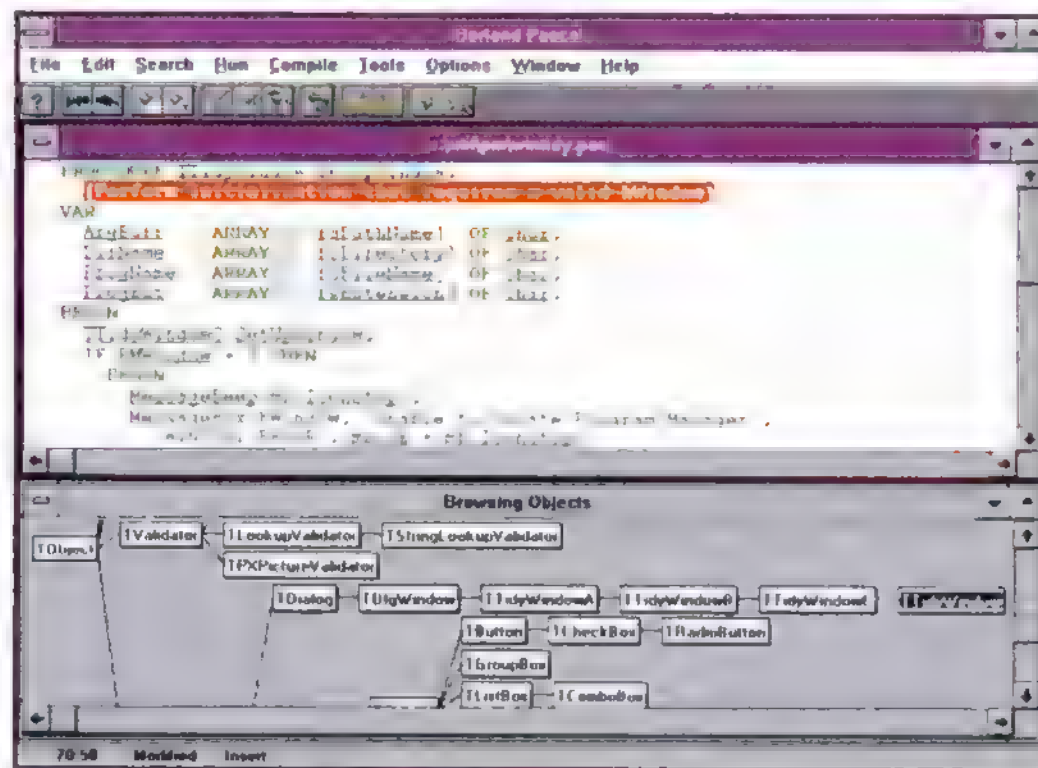
Moving up to BP7 will be easier for the TPW programmer than for the TP6 programmer,

comments are red, reserved words green, and literal strings blue, typographical errors get caught the moment they occur. The IDE can also print source code using bold and italic.

Object browsers make it easy to locate an object within the hierarchy, view the source for a particular method, and locate every line that refers to a particular routine or variable.

Compiler enhancements include support for null terminated strings in DOS programs. (The Windows compiler has always supported them.) In the realm of objects, the new keyword **Public** complements the existing **Private**, so an object can have multiple groups of public and private members. The new **Inherited** keyword in an object method makes it easier to insert new objects.

BP7 also enables *dynamic*



FREE CHOICE: BP7 compiles Windows and DOS applications.

because all of the new protected-mode features in BP7's DOS compiler are in TPW. In fact, some DOS and Windows functions have the same names and parameters. Even more amazing, DOS protected-mode programs can use *any* DLL written in *any* language, as long as the DLL doesn't call on functions specific to Windows.

ENRICHED IDES

The IDEs for both DOS and Windows offer syntax highlighting, object browsers, and a user-configurable Tools menu. When

methods in the DOS-based compiler. Unfortunately, this addition expands the VMT (Virtual Method Table) by two bytes and breaks any code that made assumptions about the internal structure of the VMT. The Turbo Vision application framework made such assumptions, so you must use the new Turbo Vision that comes with BP7.

Turbo Vision adds an input line object with parameter validation, an outliner object, and multistate check boxes. BP7's Object Windows Library also adds validated input lines and

► FACT FILE

Borland Pascal 7.0

Borland International Inc.,
1800 Green Hills Rd., P.O. Box
660001, Scotts Valley, CA
95067; 800-331-0877;
408-438-8400

List price: \$495; upgrade from any version of Turbo Pascal or Turbo Pascal for Windows, \$149.95.

Requires: 2MB RAM, 27MB hard disk space, Microsoft Windows 3.0 or later.

In short: Borland Pascal 7 has everything you need to build programs for Windows, DOS protected mode, or DOS real mode. It's a speedy and complete professional development environment.

417 ON READER SERVICE CARD

gains objects that handle printing under Windows.

Although changes to the underlying Pascal language aren't taken lightly, BP7 makes a few. In a function, a parameter of the new open-array type can take an actual array parameter of any size. The **Low** and **High** functions return the first and last index of the actual array, so it's easy to write functions to process arrays of any size.

Programmers can now streamline loops and avoid creating and testing temporary variables for loop-end conditions. The flow-control procedures **Break** and **Continue** enhance BP7's looping statements. **Break** terminates a **FOR**, **WHILE**, or **REPEAT** statement and **Continue** jumps to the next iteration.

Finally, function parameters can now be defined as constant. Constant parameters larger than 4 bytes are efficiently passed by address, but the compiler rejects code that attempts to change them.

BP7 introduces many features never before seen in a programming language while retaining its speedy compilation and ease of development. It's a complete professional development environment with everything you need to program for DOS real mode, DOS protected mode, or Windows. □

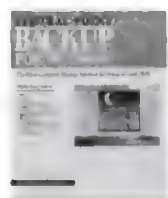
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CIRCLE 079 ON READER SERVICE CARD

■ Data Compression

Stacker 3.0 Refined for Better Compression, Easier Setup

BY WINN L. ROSCH

Along with doubling your disk space, Stacker 3.0 for Windows and DOS may end up halving your headaches. The latest incarnation of the data compression system encodes files more efficiently while requiring less user skill to wring extra capacity out of a disk drive.

The \$149 update (\$49 if you upgrade from previous Stacker versions) represents a refinement rather than a drastic change. Stacker 3.0 uses the same LZS algorithm as the original 1990 program. To trim the storage required by files, the algorithm assigns brief codes or "tokens" to longer, repeated byte sequences. Stacker 3.0 can analyze disk data more intensely than previous versions to squeeze up to 10 percent more compressed capacity from a disk, potentially adding an extra 40MB to a 200MB hard disk (nominally 400MB when compressed).

Results may vary depending on what you store on your disk. In testing, assembler source code compressed 3.9 to 1; text files by 2.6; COM files by 2.3; executable (.EXE) files by 1.5; and .PCX graphics by 1.4. Files already compressed (.ARC, .ZIP, .GIF, and dictionary files, for example) don't compress at all. Stac claims the overall compression ratio for a typical hard disk is 2 to 1. On our test disk, which was heavily laden with .EXE files, the actual ratio proved closer to 1.6.

According to Stac, the compression ratio of Stacker 3.0 is the best of any product on the market. In fact, it beat out its principal competition—SuperStor PRO from AddStor—but only by a trivial 1 percent on our test hard disk.

SPEED/COMPRESSION TRADEOFF

The price of greater compression is reduced speed. The extra 10 percent of Stacker 3.0 compression reduced disk performance by about 20 percent in informal testing with PC Magazine Labs' Hardware Benchmark Tests. Stac doesn't saddle you with that penalty, but lets

▶ FACT FILE

Stacker 3.0 for Windows and DOS

Stac Electronics, 5993 Avenida Encinas, Carlsbad, CA 92008; 800-522-7822, 619-431-7474; fax, 619-431-5726

List price: \$149; upgrade, \$49.95.

Requires: 640K RAM, 1.8MB hard disk space, DOS 3.2 or later, Windows 3.0 or later.

In short: An improved compression routine, more speed, a read/write utility, easier setup, and an Unstack feature make Stacker a better disk doubler.

ON READER SERVICE CARD

you tune performance. You can optimize for speed or capacity, or compromise by using a tuning utility or by editing your CONFIG.SYS file.

During setup, Stacker applies its most powerful compression method to pack the data already on your disk, but it defaults to highest speed for on-the-fly writing to disk. You can later "restack" to squeeze data to its most compact form.

Stacker's features put it ahead of its competitors. While SuperStor PRO offers password protection for compressed volumes, Stacker offers two levels of access—read/write and read only—so that compressed files can be distributed unaltered. Where SuperStor offers the UDE (Universal Data Exchange) feature so compressed

removable disks can be read on machines lacking the compression system, the Stacker Anywhere utility has read/write abilities.

Where SuperStor allows you to preview the compression ratio of a file, Stacker 3.0 previews an entire drive. Stacker 3.0 also automatically mounts removable media so you can slide in compressed or uncompressed floppy disks for immediate use.

EXPRESS SETUP

If you're new to PCs or disk compression, you'll find that Stacker 3.0 now ranks as the easiest system to install. An "express" setup procedure configures your PC with all the defaults through two reboots of your system with just a few presses of the Enter key.

Don't worry about memory-resident surprises, since installation automatically avoids interaction with TSR programs and disk caches by rebooting with its own CONFIG.SYS and AUTOEXEC.BAT files. Stacker has its own 64K cache, which you can move to EMS memory, and the entire 44K device driver can be loaded into high memory

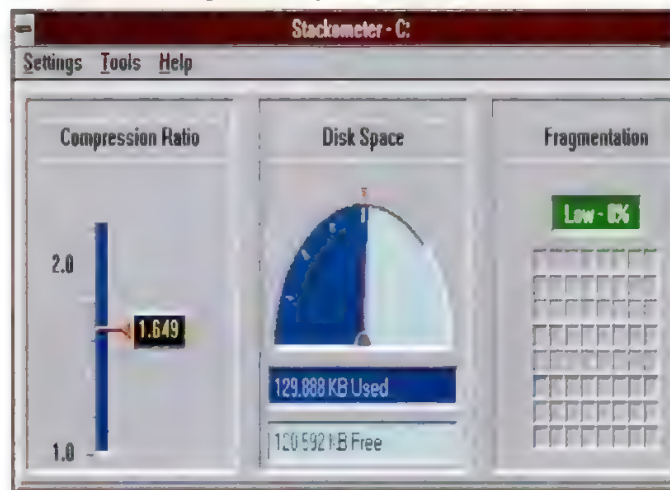
with DOS 5.0's DEVICEHIGH command. The manual is one of the best in the industry.

While Stacker 3.0 can now also be setup through Microsoft Windows, the Windows procedure does little more than push you back into the standard DOS installation, and its interface is rudimentary. You get only three new Windows programs—a "Stackometer" that reports disk usage, the current overall compression ratio, and disk fragmentation; a menu-driven control system for tuning Stacker's compression; and a reprise of the setup procedure.

DOS utilities provide more intimate control. You can manage the disk space assigned to Stacker compression, alter the speed/efficiency ratio, and even "unstack" a disk to eliminate Stacker's file compression.

DOS & COMPRESSION

If you already have a disk compression program, switching to Stacker 3.0 will give you only a bit more speed or capacity, but the little extras make it worthwhile. Reportedly, DOS 6.0 will have its own, non-Stacker compression scheme to compete with DR DOS 6.0, which includes SuperStor, but the added features and control should still make Stacker 3.0 attractive—assuming, of course, that it's compatible. But if you're looking for your first disk compression program, Stacker 3.0 leads the field. □



DISK DOUBLER: Stacker shows data compression ratios.

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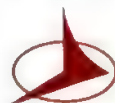
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■ LAN Reference

SOS for Networks: LAN Information on CD-ROM

BY M. KEITH THOMPSON

LAN managers are supposed to have all the answers, but for the ones who don't, Computer Library's Support on Site for Networks, a CD-ROM-based multivendor technical support database filled with information on more than 100 networking hardware, software, and communications products, can be a big help. At \$1,495 for the standalone version and \$4,995 for a five-user network license, it's expensive, but so is network down time.

SOS for Networks is the first product of its type to include technical support data on mul-

tiples applications and products from multiple vendors. It includes comprehensive support information, including proprietary "tech notes" from the support staffs of the publisher and all the vendors. As an added bonus, the CD-ROM includes ancillary software such as drivers, patches, macros, and fixes.

All this data comes from big players in networking such as ALR, Banyan, IBM, Microsoft, Novell, Quarterdeck, SynOptics, 3Com, and WordPerfect. The database includes notes on LAN Manager, LAN Server, NetWare, 3+Open, and VINES networks, with details on all types of PC clients.

Like other Computer Library products, SOS for Networks uses Lotus's BlueFish search and retrieval software, a fairly easy-to-use query tool that lets you cut through large amounts of data fast.

BlueFish includes operators like AND, OR, and NOT to let you narrow your search. For example, you would enter "NETWARE AND ATTACH AND PRINTER AND QUEUE" to find notes about connecting printers to NetWare print queues. "SWITCH AND GATEWAY AND ADAPTER" would find information regarding switch and jumper settings on a Gateway network adapter. Once you find the data you want, you can view it on screen, print it, or copy it to a file for use later.

While some of this information is available from other sources, the ability to find all

references to one topic this quickly can save hours of research. Having the data in-house means you don't have to worry about coordinating support agreements with a dozen different companies, and the number of phone calls you have to make should drop, too.

Support on Site for Networks is easy to use and full of valuable resources. It is perfect for network support professionals, including LAN administrators, systems integrators, and DP/MIS support personnel.

• List price: *Support on Site for Networks*, \$1,495 standalone, \$4,995 for up to five concurrent network users. Requires: 1MB RAM, DOS 3.3 or later, Microsoft CD-ROM Extensions 2.1 or later, CD-ROM drive. Computer Library, One Park Ave., New York, NY 10016; 800-827-7889; 212-503-4400.

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■ DOS Graphics

Instant Artist: Creative Graphics in a Flash

BY CAROL LEVIN

Micrografx's Designer and CorelDRAW are great solutions for the artist who wants high-powered drawing tools to create stunning graphics, but what if you just want to make a sign for your garage sale?

You don't necessarily need a 33-MHz 386-based computer with 8MB of RAM and a huge hard disk to take care of quick graphics tasks. In fact, you may surprise yourself with the quality of the eye-catching graphics you can create with Instant Artist, a nifty graphics package from Autodesk Retail Products.

What can a \$79.95 DOS-based graphics package deliver? All the tools you need to create signs, banners, greeting cards, business cards, letterheads, envelopes, postcards, and certificates (an \$89.95 Windows version will be available soon).

If you tend to draw a blank in the arts and crafts department,

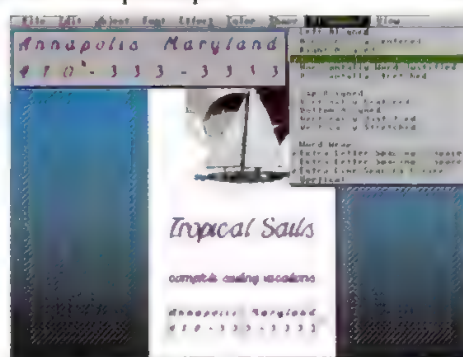
Instant Artist will come up with bright graphic design ideas for the home, the office, and for special events. As its name implies, the program takes the shortcut from initial concept to ready-to-display artwork. Using Instant Artist layouts, we designed a business card, a 51-inch banner (127 inches is the maximum), and an "apartment for rent" sign, each in about five minutes.

IMAGINATION STARTER KIT

Within the eight document types, you can choose from 400 predefined layouts; replace the canned text with your own; choose from 22 fonts (or use the Adobe Type Manager Type 1 fonts, if you have them); apply many borders, backgrounds, and special text effects (3-D, shadow, spiral); paste in new images from the program's

library of 700 editable vector-based illustrations; and apply colors from the 242-color palette. Paper supplies are available from Auto-desk.

If all these options make you dizzy, take the advice of the accompanying technique booklet: Keep it simple.



EASY GRAPHICS: Business cards are one of Instant Artist's many templates.

Working with Instant Artist is straightforward, nothing fancy. The interface is unadorned DOS, but it redraws quickly and supports a mouse. A typical layout for a sign, for instance, displays several graphic images, a border, a background, and text, each contained within its own frame. Click on an object

and its frame appears. Double-click and the editing board pops up for customizing capabilities. Easy file management allows descriptive filenames up to 24 characters long.

The emphasis in Instant Artist is on the "instant," not the "artist." The clip art is dated,

and you can't import any from other collections. The interface is efficient, but by no means elegant, and to print at 300 dots-per-inch on an HP LaserJet IIp, you need at least 1.5MB of printer memory. There is also a small collection of quotations, which seems out of place.

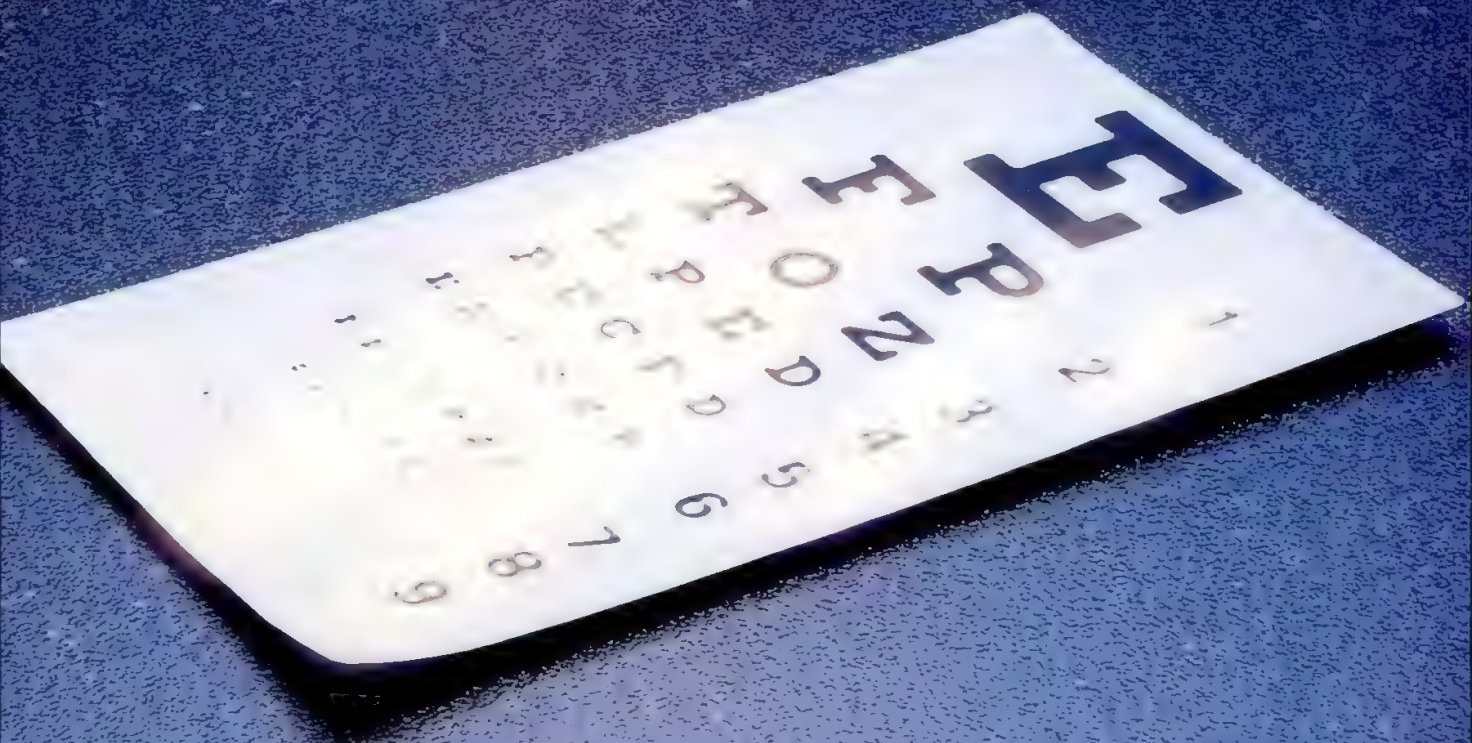
If you want to try graphic design work, if you're on a budget, or if you're in a time crunch, Instant Artist will do the job.

• List price: *Instant Artist, Version 1.0*, \$79.95; Requires: 512K RAM, 4MB hard disk space, DOS 3.0 or later. Autodesk Retail Products, 11911 North Creek Pkwy. South, Bothell, WA 98011; 800-228-3601, 206-487-2233; fax, 206-483-6969.

Circle 426 on reader service card

“Anyone who claims
that computers
are indistinguishable
from one another
needs glasses.”

— Bill Machrone,
PC Magazine, October 13, 1992





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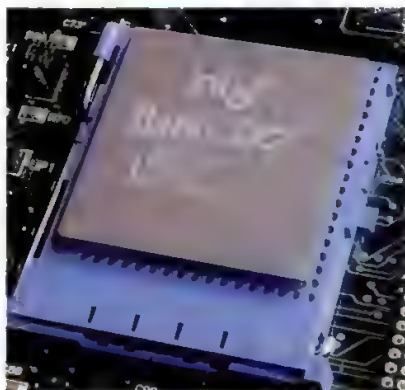
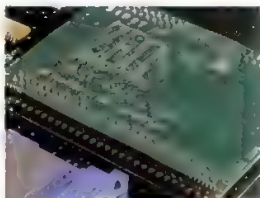
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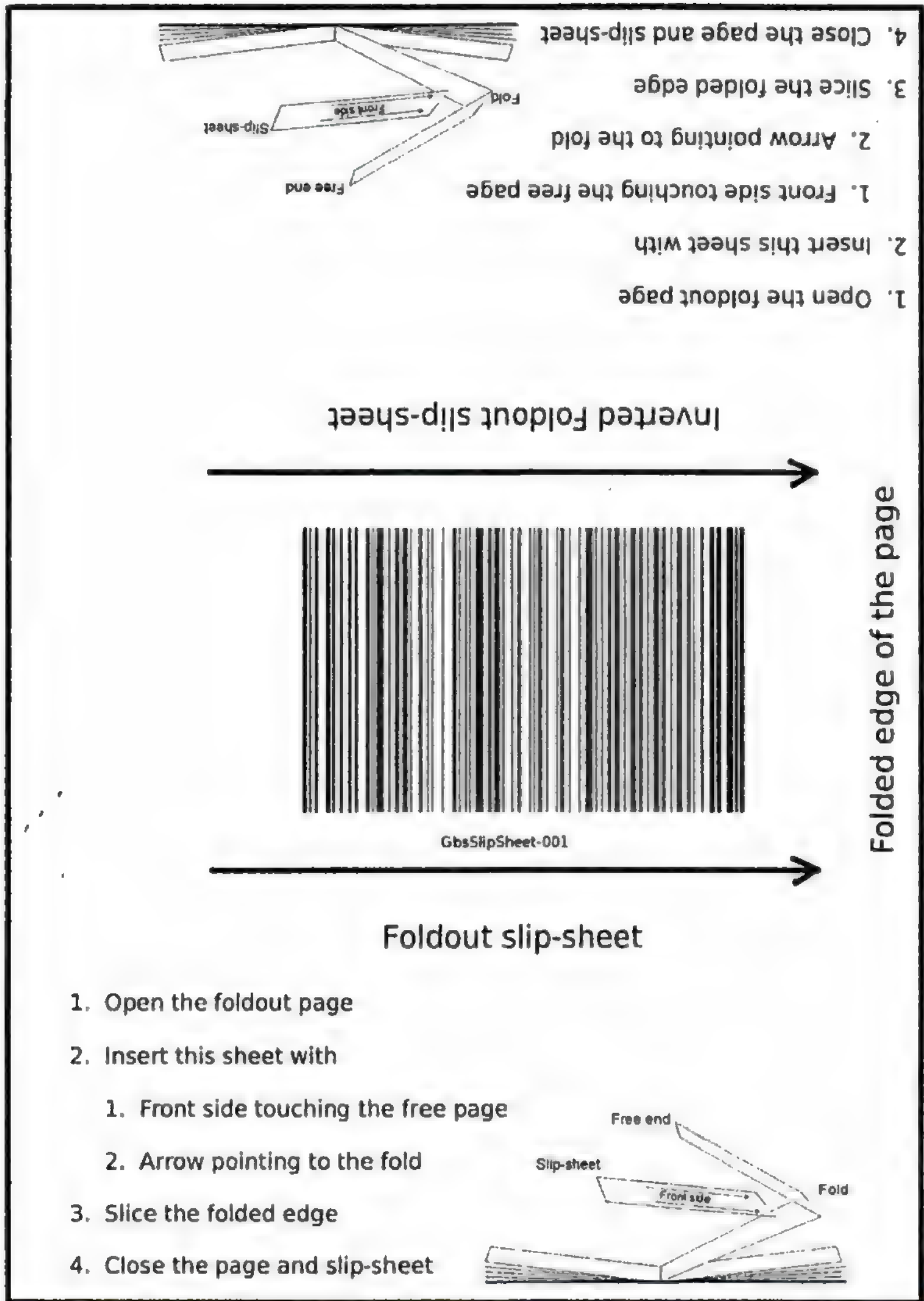
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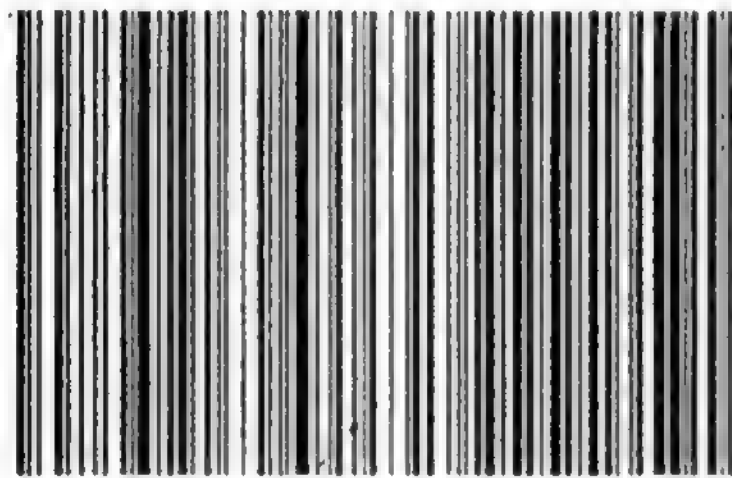
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1. Follow instructions on the other side

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GbsSlipBack-001B

Back

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Circle 151 on reader service card.

■Notebooks

Rever Cruiser Screen Doubles As LCD Projection Panel

BY HENRY FERSKO-WEISS

The 5.75-pound Rever Cruiser-325C, sold by Nova Corp International, is a 25-MHz 386SL notebook that has the unique ability to make presentations using an overhead projector. Its active-matrix color display doubles as an LCD projection panel. While the cost of the unit is a whopping \$6,495, that's still less than buying both a color notebook and a projection panel separately.

The Cruiser's active-matrix color display, manufactured by Sharp, is the real jewel in the system. It supports 256 colors at a resolution of 640-by-480, and its full-cycle pixel response rate of 30 milliseconds means there is almost no ghosting effect as an object is dragged across the display. The screen is lit from underneath, and the light is spread around evenly with a diffuser at the back.

Images on the display are relatively bright, colors are deeply and evenly saturated, and text and graphics are sharp and clear. You can adjust the screen through a full 180 degrees, which makes it easy to accommodate different lighting situations; however, the brightness/contrast control has a very narrow range.

AS A PROJECTION SYSTEM

The display can be popped off its neck and used as an LCD panel connected to the computer. Taking the panel off, removing the back, and hooking up the cable and the cooling fan takes less than a minute, and putting it all back together takes less than 30 seconds.

The display connection is much stronger and much easier to maneuver than the display in the original Cruiser, which was

first released over a year ago (First Looks, January 14, 1992). The cooling fan is also new—smaller and lighter. The first Cruiser needed direct AC power for the cooling fan, but now the fan draws power directly from the LCD panel.



DOUBLE DUTY: The Cruiser-325C's display can be used as an LCD projection panel.

The screen itself measures 8.5 inches diagonally, standard for notebook computers, but still a little small for LCD panels. When we tested the Cruiser with a 3M 300-watt overhead projector, the projected image became very clear from about 10 feet away. The colors held up well, and the screen was fairly easy to read, even though this projector wasn't ideal (the best projectors for the Cruiser start at approximately 400 watts).

With a metal-halide projector putting out 500 watts, you can project an image 10 feet wide in an undarkened room and see a bright, richly colored screen image. Because the system has an auxiliary monitor connection, you can hook up a color monitor for simultaneous

use when making a presentation. The original Cruiser couldn't do this.

If you don't want color, you can buy the Cruiser with a monochrome display for \$3,895 and upgrade to color later simply by detaching the monochrome display and plugging in the color one.

AS A NOTEBOOK

The computer supporting the LCD display is faster and much more capable than the first generation Cruiser. It has a 386SL chip rather than a 386SX, with all the typical power-saving capabilities of an SL system, including a sleep mode for all of the individual components at user-con-

trollable intervals of anywhere from 1 to 30 minutes.

In its standard configuration the Rever Cruiser-325C system comes with 4MB of RAM, a 64K RAM cache, and an 80MB hard disk. The hard disk is removable, which makes it easy to upgrade, gives you virtually unlimited storage capacity, and allows you to share the machine with other users. You can upgrade the system's memory to 8MB (\$200), and a 120MB hard disk is available for \$300 extra.

The Cruiser now conforms to a notebook profile, measuring 1.75 by 11.25 by 9.6 inches (HWD). This is a 20 percent reduction in volume from the original machine, and a weight reduction of almost 3 pounds. The complete carrying weight of the Cruiser, with two batteries,

the cooling fan, all the cables, and the nylon carrying case is only 8.25 pounds, less than the weight of the original Cruiser by itself.

Battery life of the system isn't anything to brag about. You will only get between 1 and 1.5 hours when the unit is in active use. The recharge time is 1.5 hours. You can also connect the AC/DC converter to the cigarette lighter in your car, which is another new feature.

The Cruiser's keyboard is well laid out and has a good responsive feel, and the built-in trackball works well and saves you from having to carry along another device.

Other new features of the machine include a built-in fax/modem option (\$250) and a coprocessor slot (\$119). You can also purchase a docking station for the unit that has three expansion slots and a drive bay that is suitable for CD-ROM. The docking bay fits into a miniature briefcase and has a built-in power supply.

The Rever Cruiser-325C is a portable computer/projection system that will have you impressing coworkers and clients. It's a great tool for training exercises, demonstrations, or multimedia presentations. The cost is high, but in this case, the sum of the parts is worth the investment. □

► FACT FILE

Rever Cruiser-325C

Nova Corp International Inc.,
2260 Lake Ave., #330,
Rochester, NY 14612; 716-647-6510; fax, 716-647-6512

List price: \$6,495 with 4MB of RAM, 80MB hard disk, 1.44MB floppy disk drive, 64K RAM cache, active-matrix VGA color display with 512K VRAM, cooling fan, AC/DC power converter, two rechargeable nickel cadmium batteries, DOS 5.0, nylon carrying case.

In short: The Cruiser is a 25-MHz 386SL notebook with a detachable active-matrix color display that can be used with an overhead projector for presentations.

421 ON READER SERVICE CARD

■Printer Enhancements

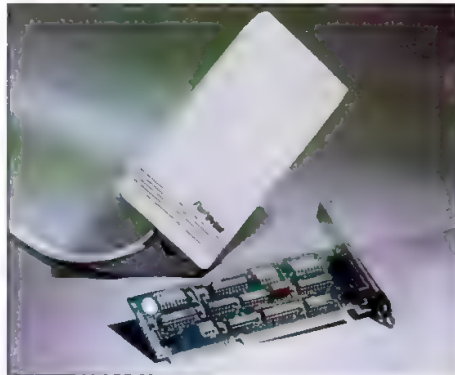
FlashPrint: The Only Speed Enhancer For the HP LaserJet IIP and IIIP

BY EDWARD MENDELSON

Elite High Technology's \$299 FlashPrint 100 is the first product designed to speed Microsoft Windows printing that works with the 4-page-per-minute HP LaserJets IIP and IIIP as well as with 8-ppm models like the HP LaserJet II, IID, III, and IIID.

The product consists of a 16-bit add-in card that you plug into your PC, a cartridge you plug into a font slot in a LaserJet, and a cable that connects the two. When you print, the FlashPrint Windows driver generates an image of the page inside your computer at a speed greater than the printer's internal controller can achieve. Then, the cartridge prints it at top speed, using any resolution-enhancement technology built into the printer itself.

Unlike most other add-in boards that enhance LaserJet printers, FlashPrint offers only increased output speed, and



FLASHPRINT: Speed boost for 4-ppm printers.

doesn't increase output resolution beyond the LaserJet's built-in 300 dots per inch. However, unlike comparable add-in products, FlashPrint takes advantage

of resolution enhancement technologies such as the kind found in the LaserJet III series.

The cable attached to the cartridge makes FlashPrint look more ungainly than competing products, such as LaserMaster Corp.'s WinJet/300 or Myriad's PrintSprint (*PC Magazine*, November 24, 1992, p. 210). But if you have a 4-ppm printer without a video port, FlashPrint's cartridge is the only way you can accelerate printing at all.

A one-page PageMaker graphics file took 26 seconds to print with FlashPrint, compared to 40 with the LaserJet alone.

But the difference was smaller with a 10-page Word for Windows text file: 91 seconds with FlashPrint, compared to 99 with the bare LaserJet.

You can buy either the \$299 FlashPrint 100, with enough RAM in the cartridge to print a letter-sized graphics page, or the \$349 FlashPrint 150, with enough RAM to print a legal page. If you want to print faster from Windows with a LaserJet IIP or IIIP, the 150 is your only option, and it's an excellent one. If you use an HP 8-ppm model, consider moving up to the WinJet/800, which offers high speed, high resolution, and PostScript-compatible graphics. • List price: *FlashPrint 100*, \$299; *FlashPrint 150*, \$349. Requires: 4MB RAM; Microsoft Windows 3.1 (in 386 Enhanced mode); Hewlett-Packard LaserJet II through IIID, Epson EPL 8000 or ActionLaser II. Elite High Technology Inc., 3848 Del Amo Blvd., #303, Torrance, CA 90503. 800-229-7888, 310-370-2762; fax, 310-542-4378.

Circle 418 on reader service card

■Multimedia

Pull Together Presentations With VideoShow HQ

BY JAMES KARNEY

General Parametrics Corp.'s VideoShow HQ is a modular system for creating and showing multimedia productions—so modular, in fact, that the PC is an optional device.

When fully configured, the system can mix still and video images, sound, animation, illustrations, and charts from most popular PC graphics applications. Targeted at serious users, VideoShow HQ's base price starts at \$4,999 and increases as you add options. To take full advantage, you may spend twice as much for tape decks, CD players, a slide maker, and a very sophisticated remote control.

The core of the system is a computer about the size of a large laptop, containing a 25-

MHz Intel 80960 RISC CPU, 2MB RAM, a 3.5-inch floppy drive (it reads both DOS and Mac disks), two standard 9-pin display ports providing VGA-quality output with 200,000 colors, two SCSI ports, two serial ports and one parallel port, a remote control jack, and a BNC connector to attach a slide maker. A proprietary operating system is built into the unit to set up the system and run presentations. It works like a cross between a VCR and a fax machine, using menus operated from a remote control.

There are over 120 broadcast-quality

transition effects, and the slides we created looked very good. Dissolves, fades, and other effects moved smoothly from one image to another. Choose the effects or let the unit generate them in random order. Timing can be handled manually from a remote control or managed by an internal clock.

Accessing VideoShow's full range of features requires adding the ARC remote control, a video deck, a sound card, an im-

age capture board, speakers, a large VGA monitor, and a PC connected to the VideoShow unit via a SCSI adapter. The handheld ARC costs \$1,299 and lets you preview images on a color LCD panel, view notes, and control all system functions.

We test drove the VideoShow with a Sony CDV-1000 8mm video deck, a Canon A1 camcorder, and a Toshiba 3301E CD-ROM drive. Setup was complex (we got little help from the several manuals), but once everything was hooked up, all went well. The VideoShow may not bring multimedia to the PC masses, but it will find a place of honor in many media labs and audio-visual departments.

• List price: *VideoShow HQ*, \$4,999; *ARC Remote Control* \$1,299. Requires: 512K RAM, 2MB hard disk space, free slot for SCSI adapter. General Parametrics Corp., 1250 Ninth St., Berkeley, CA 94710; 800-223-0999, 510-524-3950.

Circle 419 on reader service card



VIDEOSHOW HQ: A presenter's dream tool.

PCs

NEC Gets Ready For Mass Market Competition

BY BRUCE BROWN

NEC Technologies has joined Compaq, Dell, IBM, and many other PC vendors in introducing a value line of PCs, and in this case the company has chosen to bundle in several software packages to make the systems appeal to new users. Savvy PC shoppers can assemble more powerful systems for less money, but NEC is betting that novices will pay more for "plug-and-work" PCs with a recognizable brand name.

NEC's Ready Systems are available at three processor speeds with one monitor option. They're being sold primarily via the mass-market channel. Traditionally, NEC has sold only through authorized dealers.

The three systems—one 386-based and two 486-based computers—are on the market with "expected price points" rather than list prices. The 25-MHz 386SX-based Ready 325 sells for less than \$1,119, the 25-MHz 486SX-based Ready 425 for less than \$1,499, and the 33-MHz 486DX-based Ready 433 for less than

\$1,849. The Ready 1024 Monitor sells for less than \$399.

Each of the Ready models comes in a low-profile 4.5-inch-high by 15.5-inch-wide by 17-inch-deep case. The case top unlatches with a simple plastic twist latch—a single one-quarter turn and you can lift off the cover.



READY PC: The 433 is the fastest performer.

Inside a Ready System you'll see a small motherboard, a 145-watt power supply, and three populated drive bays. Two floppy disk drives, one 1.2MB and one 1.4MB, are standard, as is an IDE hard disk drive. The

Ready 325 has a 120MB hard disk; the two 486 systems come with 170MB hard disks. You can't add other drives; there are no available drive bays.

Video, I/O, and disk drive interface circuitry and controllers are all integrated on the motherboard, so the system's three horizontally mounted 16-bit ISA expansion card slots are free. A 2,400-bits-per-second data/9,600-bps fax send/4,800-bps fax receive modem is also on the motherboard.

The Ready 325 comes standard with 2MB RAM expandable to 20MB. The Ready 425 and 433 models have 4MB, expandable to 64MB, and also include an Intel OverDrive socket for CPU upgrades. None of the

Ready Systems has an external RAM cache.

Designed as Microsoft Windows systems, the Ready PCs emphasize video response and quality. The 486-based systems use a Cirrus Logic 24-bit video controller that supports up to 16.8 million colors in VGA 640-by-480 mode or 256 colors at 1,024-by-768 resolution. The Ready 325 has a 16-bit video chip.

The 14-inch fixed frequency VESA-compatible Ready 1024 Monitor is a fine complement to a Ready PC. It runs in 1,024-by-768 mode for users with good eyesight, but 640-by-480 or 800-by-600 modes are better, given the monitor's size.

NEC includes several software packages with the Ready Systems. All have DOS 5.0,

FACT FILE

NEC Ready Systems

NEC Technologies Inc.,
1414 Massachusetts Ave.,
Boxborough, MA 01719;
800-388-8888, 508-264-8000;
fax, 800-366-0476

List price: Ready 325: less than \$1,199 with 2MB RAM, 120MB hard disk, 1.44MB and 1.2MB floppy disk drives, 2,400-bps data/9,600-bps fax modem, DOS 5.0, Windows 3.1, NEC Desktop by Peter Norton, Norton AntiVirus, PFS:WindowWorks, Delrina WinFax, Prodigy, mouse. Ready 425: less than \$1,499 with 4MB RAM, 170MB hard disk, Quicken for Windows. Ready 433: less than \$1,849. Ready 1024 Monitor: less than \$399.

In short: NEC Technologies' Ready Systems are hardware/software bundles suitable for home or small office use. Video performance is above average, but there's no drive expansion room.



ON READER SERVICE CARD

NEC Desktop by Peter Norton, Norton AntiVirus, PFS:WindowWorks, Prodigy, Windows 3.1, and Delrina WinFax, as well as an on-line tutorial program. The 486-based Ready Systems also come with Quicken for Windows installed.

Since many Ready buyers will be new PC users, NEC includes a videotape covering setup and upgrade procedures.

The Ready Systems come with a one-year parts and labor warranty with on-site service and lifetime toll-free technical support. They also include ReadyRemote, a remote support boot disk that comes with the system to let a NEC technician check your system remotely via the Ready PC's modem.

At their expected price points, the NEC Ready Systems aren't much of a deal in today's competitive marketplace; many mail-order vendors offer similar hardware for less money with almost as much support and user-friendliness. With a decent discount, however, the Ready Systems are fine choices for those who won't need to add drives later on. □

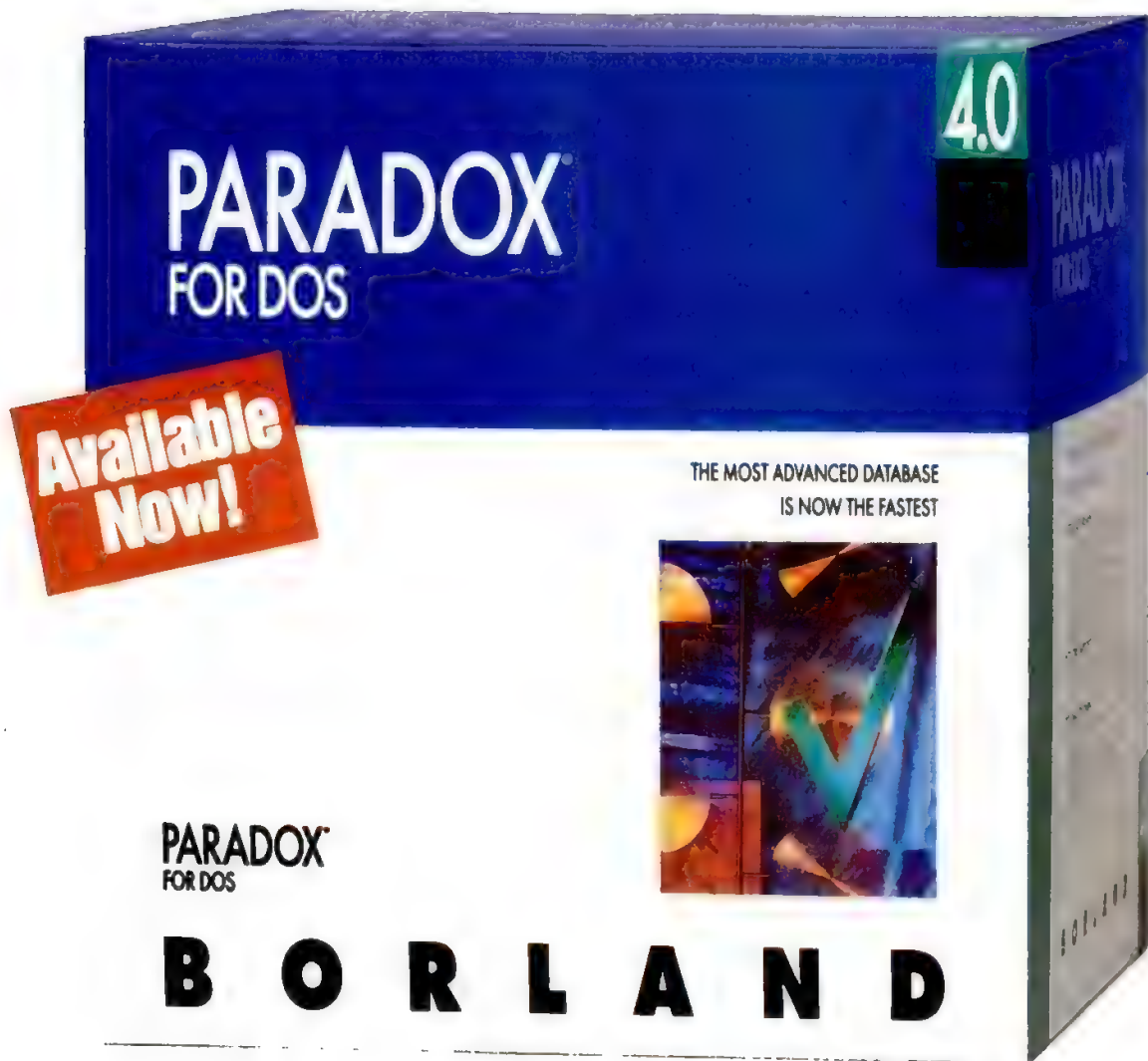
Benchmark Tests: The NEC Ready 433

We tested the fastest of the three Ready models, the 33-MHz 486DX-based 433. Like the other two machines, it is designed to be a Microsoft Windows system, and its integrated video logic produced an above-average Graphics Winmark score.

We used PC Magazine Labs' Hardware Benchmark Tests, Release 7.0, to measure the PC's processor, memory, video, and disk subsystem performance. The Graphics Winmark score is based on 12 Windows graphics and text functions, weighted to reflect how frequently the various functions are used.

Higher scores represent better performance.	Processor (operations per second)	Memory (kilobytes per second)	Video (thousands of operations per second)	Disk (kilobytes per second)	Graphics Winmark (megapixels per second)
NEC Ready 433 (33-MHz 486DX)	7,713	4,659	3,500	20.73	4.70
33-MHz 486DX average	8,753	4,723	3,843	47.30	4.09

Not so fast Microsoft—
**the world's *fastest* PC database
comes from Borland!**



An offer that will get you up to *speed* now!

**Ranked #1
in performance!**

Upgrade to Paradox 4.0 now!

Independent tests (*InfoWorld*, September 1992) prove that new Paradox® 4.0 is the fastest, most powerful database among those tested. And it's available now! (Compare that with Microsoft's offer. They want you to pay \$200 now for a slower product with the promise of getting an unannounced upgrade as soon as it comes off the vaporware list.)

Paradox is fastest

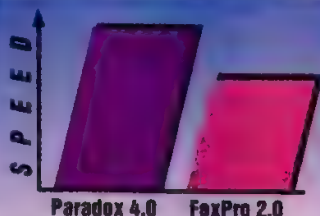
Thanks to Borland's new WarpSpeed™ performance, Paradox 4.0 sets the standard in performance for both network and stand-alone use. For you, this means faster answers to queries, faster memory access, and faster multiuser applications. (Don't be misled by Microsoft ads that claim FoxPro is the fastest. It's old news.) As *InfoWorld* put it in the speed tests for Querying/Reporting: "Paradox is the hands-down winner, not only in speed, but in maintaining an amazingly consistent performance as the tests became more complex."

Unmatched power and ease of use

In addition to unmatched performance, Paradox 4.0 sports a new windows-like interface with pull-down menus, dialog boxes, windows, and mouse support. This new interface makes Paradox the most usable database for everyone in your corporation.

Paradox is renowned for its ease of use. Paradox introduced Query By Example, the easiest way ever for users to get at their

More than 25% faster!



Paradox is #1 in performance!

Total time to complete all query, report and transaction performance tests: Paradox, 14:49:36; FoxPro, 20:06:13

"Tuned-up Paradox 4.0 speeds past FoxPro 2.0."

InfoWorld product comparison, September 28, 1992.

data. And Paradox forms and reports are a snap to create. You can even build multi-table forms and reports, all without programming.

With Paradox 4.0, you can also manage more types of data in more ways than ever before. Paradox 4.0 includes memo fields for storing unlimited amounts of text. And new binary fields let you store any type of information—documents, spreadsheets, pictures, sound, and even multimedia.

Application development is faster, too

When it comes to application development, Paradox is ready. The Paradox Application Language (PAL™) is a powerful, high-level procedural language that allows you to cre-

ate sophisticated applications quickly. And the new Application Workshop helps developers build and distribute robust applications in record time. Now you can create custom applications that users love.

Protecting your investment

Paradox 4.0 provides a smooth migration from earlier versions. It runs all your existing Paradox 3.5 applications and can access your data transparently. What's more, Paradox talks to more of your corporate data than any other PC database, with transparent links to Oracle, Sybase/Microsoft, DEC VAX Rdb, IBM® OS/2® DBM, DB2, Novell NetWare, and InterBase™ server.* (By comparison, FoxPro talks only to itself.)

You can buy Paradox 4.0 today with total confidence because it comes from Borland—the leader in databases. Our commitment starts with best-of-breed products and follows through with the best solutions, best support, and best service in the business.

InfoWorld says it all: "Just as Borland predicted, Paradox 4.0 is faster than FoxPro 2.0."

Put the world's fastest database to work for you.

**To upgrade or order,
see your dealer today or call
1-800-331-0877, ext. 5893**

In Canada, call 1-800-461-3327



Paradox 4.0
May 1992



Paradox 4.0
August 1992



Paradox 3.5
June 1992



Paradox 3.5
June 1992



Paradox 3.5
October 1991



Paradox 3.5
May 1991



B O R L A N D
Software Craftsmanship

*Paradox SQL Link sold separately. InterBase connection available soon. Copyright © 1992 Borland International, Inc. All rights reserved. Paradox, WarpSpeed, InterBase, and PAL are trademarks of Borland International, Inc. PC Magazine Editor's Choice Award reprinted from PC Magazine, May 28, 1991. Copyright © 1989, Ziff Communications Company. Software Digest is a registered trademark of NSTL, Inc. BI 4907

CIRCLE 220 ON READER SERVICE CARD

Document Management

Imara Lite Files Images of Your Documents and Faxes

BY HENRY FERSKO-WEISS

Imara Lite, a document manager and fax processor, is the low-calorie version of Imara, which includes workgroup facilities for network installations. Running under Windows, Imara Lite provides a desktop environment for receiving and filing incoming faxes, scanned images, and imported files, all for \$295.

Imara Lite's filing system is a hierarchical database. Under the database umbrella you establish sets, categories, folders, documents, and finally, in the case of image documents, pages. Each of these levels can be represented by an icon and placed on your desktop.

Setting up the filing system is easy. A hierarchical structure might, for example, include these levels: a set for Accounting, a category for Expenses, and a folder for Travel. It's only when you get to the document level that you work with actual information.

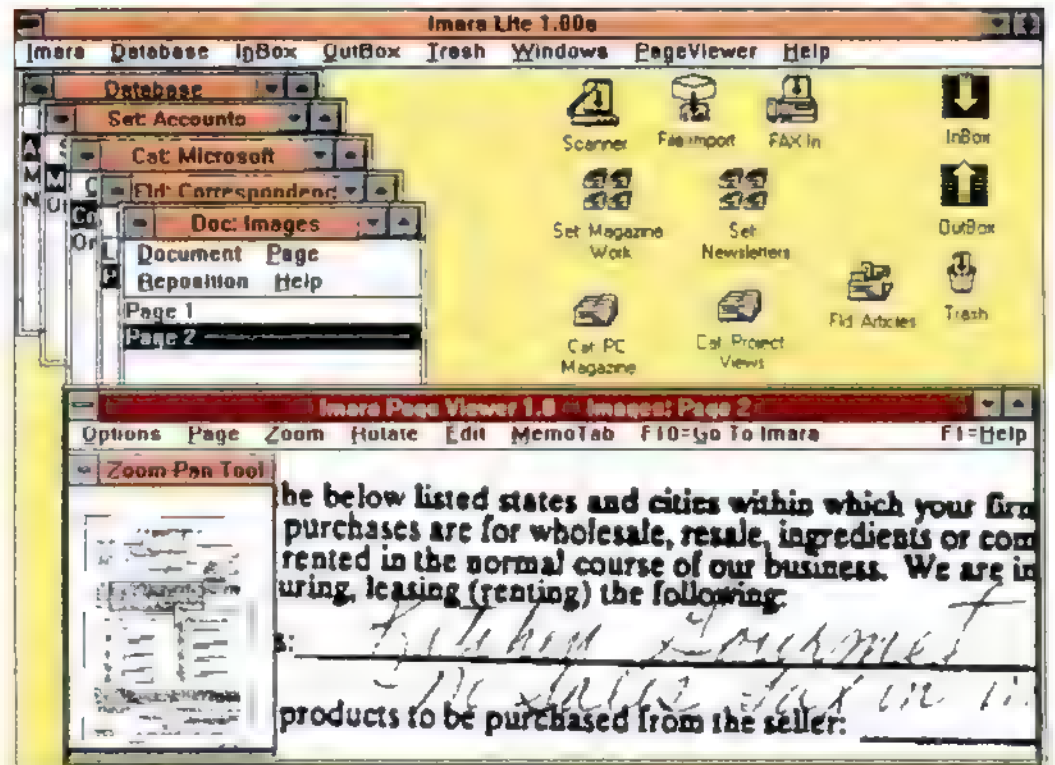
With Imara's filing system you keep all the documents that relate to a particular job, project, or client together. These files don't have to be all text. They can include faxes, image files, spreadsheets, or anything else. You locate files through keyword or field searches.

Imara Lite automatically receives faxes from Class 2 compatible fax modems, Hayes JTFax 9600B modems, or DCA/Intel CAS compatible modems, and converts them to Imara format documents. Faxes are temporarily stored in the InBox. From there, you move them to an appropriate folder. Scanning is equally simple.

Once you have an image file from the scanner or fax board, you can zoom in and out on a page. You can also rotate the page, mirror the image, display

it in reverse video, or annotate it with text or voice Post-it-type notes. Unfortunately, the only direct editing is cutting and pasting parts of an image to the Clipboard. This lets you export the image to a richer image-processing program and reimport it, a cumbersome process.

Imara Lite's faxing, scanning, and image processing facilities let you turn paper into computer images and view them, but you can't do any direct editing, which is a drawback. That disadvantage is balanced by the good hierarchical filing system and program launching facilities that make it possible to



VIEWER: Imara Lite zooms in on your fax images.

keep all your work on a single subject together.

• List price: *Imara Lite, Version 1.00a*, \$295. Requires: 4MB RAM, 1MB hard disk space, Microsoft Windows 3.0 or later,

DOS 3.3 or later. Imara Research Corp., 111 Peter St., #804, Toronto, Ontario, Canada M5V 2H1, 416-581-1740; fax 416-581-1605.

Circle 401 on reader service card

Desktop Publishing

Publish It! for Windows: Feature-Rich DTP for \$149

BY ROBERT KENDALL

Publish It! for Windows, from Timeworks, proves that low cost doesn't necessarily mean low-end when it comes to desktop publishing. In its power, ease of use, and price, this \$149.95 package is comparable to Microsoft Publisher and Power Up's Express Publisher for Windows, but it has a few unique characteristics.

Like its competitors, Publish It! for Windows offers a clear,

intuitive interface with a toolbar for quick access to most functions. A copious selection of over 100 templates will get you started with brochures, newsletters, menus—you name it.

Named paragraph styles give you easy control over most aspects of formatting, including automatic bulleting. The program doesn't offer as much sophistication as Express Publisher for Windows when it comes to character spacing, kerning, and leading, but you usually get nice results without much effort.

Manipulating text and graphics frames, or creating borders and tinted backgrounds for them is a straightforward process. Particularly noteworthy is the program's capability to create an

irregular boundary around a graphic or text element and then wrap text around it. Unlike Microsoft Publisher, however, Publish It! for Windows doesn't support multiple columns in a single text frame.

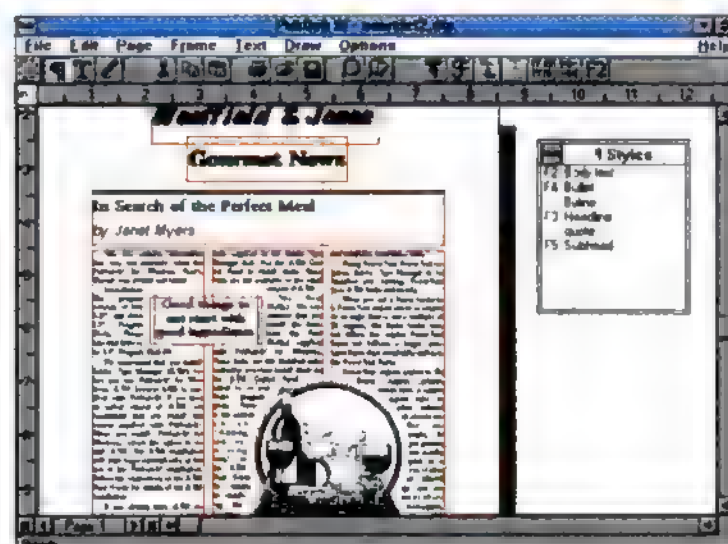
You can import standard word processing formats and a wide variety of graphics files. Besides the usual .BMP, .CGM, .EPS, .PCX, .TIFF, and .WMF formats, you can bring in .GEM, .IMG, and others. You can scale and crop graphics, and there are even crude tools for editing them.

Like its competitors, the package can create special text effects for headlines. You can rotate or skew text, wrap it in a circle or around a curve, fill it with patterns, and color it.

You can also buy the package on CD-ROM for the same price as the floppy disk version and get 3,000 pieces of clip art and 300 extra templates.

• List price: *Publish It! for Windows*, \$149.95. Requires: 2MB RAM, 1.5MB hard disk space, Windows 3.0 or later. Timeworks Inc., 625 Academy Dr., Northbrook, IL 60062; 800-323-7744, 708-559-1300; fax, 708-559-1399.

Circle 402 on reader service card



LAYOUT: Publish It! for Windows lets you wrap text around irregular objects.

■Multimedia

Media Vision Pulls Together Bargain Upgrade

BY JULIE COHEN

Nothing is as easy as it should be. Yes, you can pull Media Vision's Fusion CD multimedia upgrade kit off a shelf in Circuit City or Wal-Mart. It'll even cost you less than \$500. But once you get it home, you may have to rely on luck to get it installed properly.

Installing the hardware is easy enough. The directions are clear, and just about anyone can put these components together. Fusion CD requires a 386-based system with two full-length, adjacent, open slots—one for the Pro AudioSpectrum sound card, and one for the SCSI interface card that drives the external CD-ROM.

In theory, software installation should take even less effort. The install program gives you two choices: Quick Start and Manual, which allows more advanced users to select IRQ and DMA values to avoid potential conflicts.

Unfortunately, when PC Magazine Labs installed the Fusion CD upgrade kit on two PCs, it worked successfully on only one. Though the CD-ROM drive and speakers worked on the first system, Microsoft Windows 3.1 crashed and had to be reinstalled. The CD-ROM drive, the speakers, and Windows never ran simultaneously on that system.

We had far better luck on the second system. Installation was comparatively smooth, and the equipment worked under both DOS and Windows.

Make no mistake: Fusion CD is an entry-level multimedia upgrade. The NEC CDR-25BJ CD-ROM driver has a 650-millisecond seek time, which is far slower than NEC's \$499 entry-level standalone model, the CDR-37. There are many CD-ROM titles that can handle the slower speed; however, video segments suffer.

Fusion CD's audio components include Media Vision's Pro AudioSpectrum card and a pair of Labtec CS-550 speakers. The 8-bit, 22-KHz sound card is fine for running most of today's CD-ROM programs. Combined with the small speakers, however, audio CDs sound more like AM radio. If you demand better audio quality, Media Vision sells a 16-bit upgrade kit, Fusion-16 CD, in computer stores.

The speakers fall in the middle of Labtec's line. They contain one driver instead of separate woofers and tweeters, and require four C batteries for amplification and treble and bass control.

Media Vision bundles four software titles to turn your new multimedia PC into a real family machine: Broderbund Software's Where in the World is Carmen Sandiego? for kids, Compton's Family Encyclope-

dia (an adequate, though by no means breathtaking, reference tool), and two Origin programs for serious game players: Ultima Underworld: The Stygian Abyss, and Wing Commander II.

Manufacturers have yet to make multimedia as easy to set up as it is enjoyable to use. Once you do get the multimedia kit up and running, you'll regret having waited so long.

• List price: *Fusion CD*, less than \$500. Media Vision Inc., 47221 Fremont Blvd., Fremont, CA 94538. 510-770-8600; fax, 510-770-8648.

Circle 420 on reader service card

■Communications Software

QmodemPro Integrates E-Mail and Fax with On-Line Communications Manager

BY JOE SALEMI

With the release of QmodemPro, Mustang Software has delivered on the promises it made when it bought the popular shareware program Qmodem from John Friel in early 1992. It's an entirely new program, completely rewritten by Friel and Mustang, but the price remains a very reasonable \$99, or \$35 upgraded from previous versions of Qmodem.

The program includes a new version of the Off-line Xpress (OLX) mail reader that can read and reply to electronic mail downloaded from CompuServe or MCI Mail, and it can even route messages through those services to fax numbers, or Internet and MHS gateways.

The built-in address book in OLX 3.0 has been expanded to hold names, user IDs, preferred e-mail service, and fax numbers. You can even read a message from one service and route your reply to a different service.

Mustang has included a real-time spell-checker that you can use to check your messages before sending them off. OLX lets you attach one binary file to a message, and QmodemPro will automatically upload it when it

connects to the appropriate service. The one-file limitation is a minor annoyance for MCI Mail users (MCI supports multiple file attachments), but Mustang is exploring ways of supporting multiple files in a future version.

QmodemPro's dialing directory has also been enhanced. The mail packet name for a particular service can be included as part of its directory entry, and QmodemPro will automatically flag the entry in the list to let you

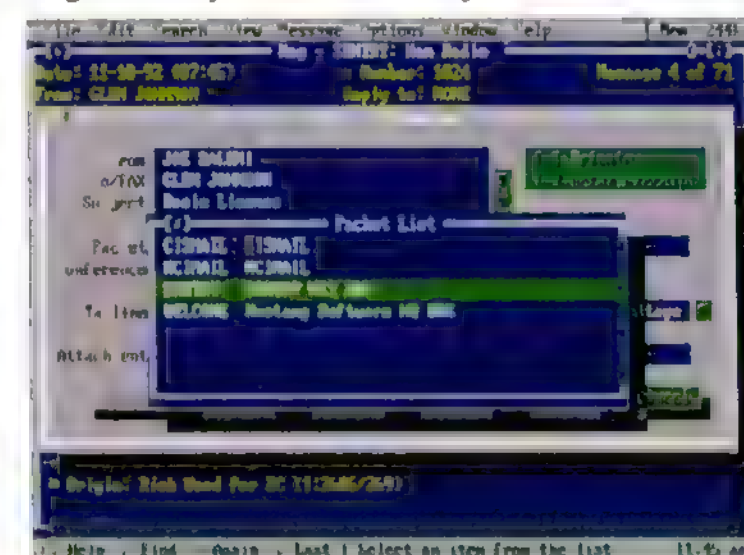
nate phone numbers; if the first is busy, QmodemPro will try the next one on the list. One nice addition is the Group feature, which lets you add any number of directory entries into a named group. You can tell QmodemPro to dial the group instead of individual entries, and it will go through the list and handle any on-line actions until it connects with every service in the group.

QmodemPro's tightly integrated e-mail features significantly raise the standard for communications software and make it the product of choice, especially if you subscribe to a number of on-line e-mail services.

• List price: *QmodemPro, Version 1.0*, \$99; upgrade from prior shareware versions \$35.

Requires: 384K RAM, 2MB hard disk space, DOS 2.0 or later. Mustang Software Inc., P.O. Box 2264, Bakersfield, CA 93303; 805-395-0223; fax, 805-395-0713.

Circle 422 on reader service card

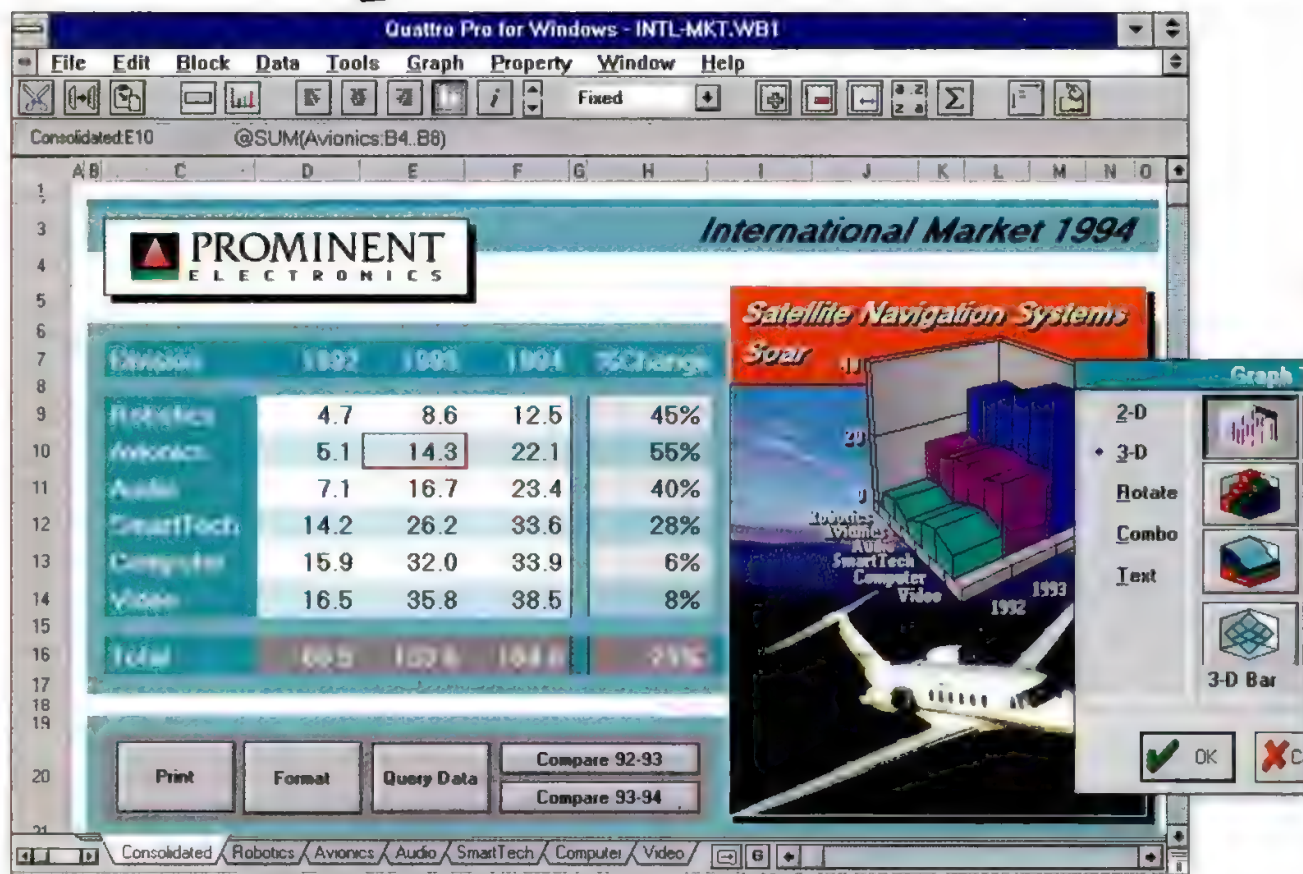


MESSANGER: QmodemPro's tightly integrated e-mail features let you access many services.

know that you have messages waiting to be read or uploaded.

Commands have been added to script language to completely automate the process of calling a service and exchanging mail. Each entry supports five alter-

Excel and 1-2-3- Quattro Pro



Quattro Pro for Windows is the easiest-to-use spreadsheet ever made. Built with Borland's renowned object-oriented technology, Quattro® Pro for Windows is packed with hot new features you won't find in any other spreadsheet.

NEW! Spreadsheet Notebooks with customizable Tabs are nothing less than a revolution in spreadsheet ease of use. Now you can intuitively organize and manage your spreadsheet data.

NEW! Object Inspector™ menus end the hassle of searching through menus. They're simpler than 1-2-3. Just click the right mouse button anywhere on the screen to get a list of what you can change and change it right there.

NEW! Database Desktop™ is the easiest way to incorporate dBASE® and Paradox® data into your spreadsheet. Just what you'd expect from Borland, the leader in database technology.

NEW! SpeedFill™ and **SpeedFormat™** slash setup time by automatically filling in spreadsheet headings and formats.

NEW! SpeedBars™ are customizable and context-sensitive. SpeedBar icons give pushbutton access to your most frequently used commands.

NEW! Presentation Graphics and drawing tools that rival those of Freelance and Harvard Graphics are built-in. You don't need to buy a separate graphics package.

YES! Compatible with Lotus 1-2-3 files, macros, and publishing styles; Excel .XLS files; and eight graphic formats. Quattro Pro for Windows offers the best spreadsheet, database, and graphics file compatibility available.

1-2-3 users prefer for Windows

An Independent test proves...

It's a fact: two out of three Excel and 1-2-3 spreadsheet users tested prefer Quattro Pro for Windows to their current spreadsheet. They say it makes you more productive and is easier to learn and use. That's the result of a study conducted by

Usability Sciences Corporation, a highly regarded independent testing lab used by major software publishers, including Lotus.

▼ *The Object Inspector makes it easy to view and select your options.*

▼ *WYSIWYG printing makes it easy to create high-impact reports.*

...the easiest-to-use spreadsheet...



Quattro Pro for Windows is the most advanced, yet easiest-to-use spreadsheet ever created for the personal computer.

Thanks to the use of new object-oriented technology, Borland has radically simplified the use of the world's most feature-rich spreadsheet. With Quattro Pro for Windows you get your work done faster because you work visually. Simple point-and-click operations are all that's needed to complete any spreadsheet task—from building your spreadsheet to creating dazzling graphical reports.

...makes you more productive

Never before has so much spreadsheet power also meant this much user productivity. Spreadsheet Notebooks and Object Inspector menus are breakthrough concepts that make it easy to tap the awesome functionality of Quattro Pro.

Only Quattro Pro for Windows gives you transparent access to database information. Borland's unique Database Desktop lets you view, edit, and copy dBASE

and Paradox tables directly from within Quattro Pro. Plus, we've included all the tools you'll ever need for creating your own custom spreadsheet applications.



Quattro Pro for Windows
November 10, 1992

"Quattro Pro for Windows is a better spreadsheet than Excel 4.0."

—Computer Shopper, November 1992

1-2-3 and Excel users tested prefer Quattro Pro for Windows two to one. But why not see the world's best Windows spreadsheet for yourself? Get Borland's new Quattro Pro for Windows today.

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In Canada, call 1-800-461-3327.



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Software Craftsmanship

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Notebooks

Object Inspector

Database Access

1-2-3 Compatibility

Windows Offer

New & Improved

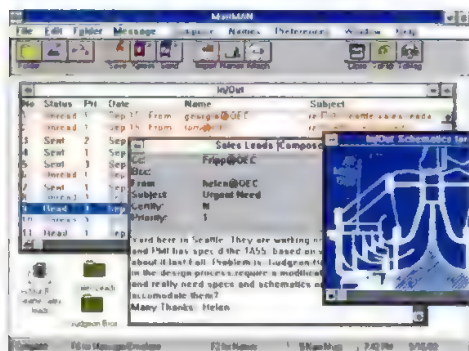
NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Emerson Andrew Torgan

IMPROVED

MailMAN 2.0 Adds New Mail-Management Features

Reach Software's MailMAN, Version 2.0 for MHS, is a Microsoft Windows-based open e-mail client that enables you to access a wide variety of electronic mail servers, databases, and applications. The update has a variety of mail management features and optional mail modules for extending e-mail functionality. New mail management features include an enhanced user interface offering addressing and attaching files by means of one or two mouse clicks. MailMAN features fast message composing and direct access to LAN directories, as well as full support for bidirectional DDE (Dynamic Data Exchange), which allows you to launch MailMAN from within other Windows applications or to launch applications from within the mail environment. Attached files can be viewed, edited, or printed.



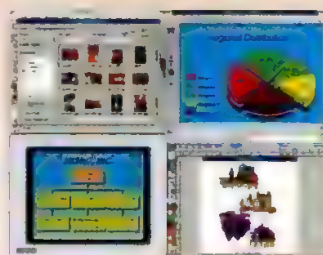
MailMAN lets you access e-mail servers.

Optional mail modules, such as Mail Archiving and a Forms Pack with a standard set of forms (including a sequential route list and phone message slip), range in price from \$299 to \$399 and are available licensed on a per-server basis for unlimited use. Additional modules include a Mail Sorter/Filtering module, a Spell-Checker, and a Conference Module that lets users establish shared mail conferences with other users. MailMAN 2.0 supports NetWare MHS and VINES Mail.

• List price: *MailMAN, Version 2.0 for MHS: 25 users, \$995; unlimited users per mail server, \$2,295. MailMAN, Version 2.0 for VINES: unlimited users per mail server, \$1,495. Reach Software Corp., 330 Potrero Ave., Sunnyvale, CA 94086; 408-733-8685; fax, 408-733-0482.*

Circle 404 on reader service card

HOT PROSPECT



Micrografx Takes On Corel With \$295 Graphics Toolkit

Not content to sit back and watch rival Corel Systems move ahead with its all-in-one graphics solution, **Micrografx** has unveiled its own jack-of-all-trades graphics toolkit. Graphics Works for Windows, Version 1.0, includes the latest versions of Windows Draw and Windows OrgChart, as well as the new entry-level photo image editing and painting program, PhotoMagic. The \$295 package also offers a slide-show utility, 10,000 clip-art images, over 150 TrueType and Type 1 fonts, and over 1,000 stock-quality photo images.

Windows Draw, a drawing and desktop publishing application, provides drawing tools. It has object manipulation tools including reshape, rotate, flip, and align. Special effects include blend, slant, and stretch. Windows OrgChart includes organizational charts with photo and note options, and nine different work styles. PhotoMagic has paint, clone, eraser, flood, and gradient tools, along with color adjustment, contrast, brightness, and hue correction tools. PhotoMagic includes an ImageBrowser, providing thumbnail views; an EffectsBrowser that lets you view an effect prior to application; and ScreenMagic, a Windows wallpaper creation utility.

• List price: *Graphics Works for Windows, Version 1.0, \$295. Micrografx Inc., 1303 Arapaho, Richardson, TX 75081; 800-733-3729, 214-234-1769, fax, 214-234-2410.*

Circle 403 on reader service card

IMPROVED

FTP Ships Update of Low-Cost Network Protocol Analyzer

FTP Software's LANWatch, Version 3.0, is a software-only network protocol analyzer that runs under DOS, monitoring and troubleshooting LANs, and isolating performance problems. It captures, parses, displays, and saves packets to disk in real time and recognizes hundreds of protocols, including IPX, NetBIOS, Apple-Talk, and TCP/IP.

The new version offers network administrators a number of enhancements to the parsing and filtering capabilities, the user interface, and the help system and documentation. Filters may now be saved to a file and loaded back into LANWatch. By typing the first few characters of a filter, the program automatically completes the filter or brings up a list of possible choices that match the string. Mouse support lets you move through the queue of packets and all program screens. In Examine mode, packets may now be marked, letting you jump back while examining as many as ten packets at a time.

• List price: *LANWatch, Version 3.0, \$1,200. FTP Software Inc., 2 High St., N. Andover, MA 01845; 508-685-3300; fax, 508-794-4477.*

Circle 405 on reader service card

NEW

Central Point Delivers NetWare Antivirus Solution

Central Point Software is shipping the Central Point Anti-Virus for NetWare, Version 1.0, a virus protection program for NetWare 3.11 networks. Anti-Virus for NetWare includes server protection with real-time scanning capabilities in a NetWare Loadable Module (NLM) developed by Central Point, and integration with desktop systems protected by the company's other antivirus products. According to the company, integration between multiple servers and desktop systems on a network is achieved via CentralTalk, a new communications protocol that enables desktop systems and servers to transparently communicate virus information across the network.

Anti-Virus for NetWare contains a server protection NLM that provides real-time scanning of all files as they are sent to, or retrieved from, the server, and a master NLM that estab-

New & Improved

lishes linked server communication. It can also be configured to scan files on demand at prescheduled times or at specific intervals. When a virus is detected on either a desktop system or a server, CentralTalk warns all networked servers of the infection. CentralAlert, a notification system built into CentralTalk, automatically alerts the LAN administrator's workstation or pager, and can be configured to alert all networked users. Virus signature updates can be distributed by the administrator from the master NLM.

- **List price:** *Central Point Anti-Virus for NetWare, Version 1.0*, \$1,199 (includes a single-server license, and a five-user license for any mix of *Central Point Anti-Virus for DOS* and *Central Point Anti-Virus for Macintosh*). *Central Point Software Inc.*, 15220 NW GreenBrier Pkwy., #200, Beaverton, OR 97006; 503-690-8090; fax, 503-690-8083.

Circle 406 on reader service card

NEW

DEC's 325p Notebook Ships With Two Trackballs

As they say, "If one is good, then two is better." **Digital Equipment Corp.** endorses this philosophy, and as a result, the company is shipping its DECpc 325p notebook system with two pointing devices. The first is a traditional external clip-on trackball (Logitech's Trackman). The second is a built-in mini-trackball located above the keyboard for those constrained times when an external device isn't practical.

The DECpc 325p is a 386SL-based notebook running at 25 MHz, with a 16KB cache and a 10-inch backlit VGA LCD that supports 32 shades of gray. The unit weighs in at 5.9 pounds and ships in standard configuration with 2MB RAM, a 3.5-inch floppy disk drive, an 80MB hard disk, an internal 2,400-bps data/9,600-bps fax modem and FAXit software, DOS 5.0, Windows 3.1, and QA Plus.

- **List price:** *DECpc 325p*, \$2,620. *Digital Equipment Corp.*, 146 Main St., Maynard, MA 01754; 800-722-9332, 508-486-6422.

Circle 407 on reader service card

NEW

Lexmark Rolls Out IBM Color Jetprinter PS 4079

Lexmark International has unveiled the first IBM desktop color printer that is PostScript-compatible. The IBM Color Jetprinter PS 4079 features AMD's Am29200 32-bit RISC processor and provides simultaneous connection to PCs and Macintoshes. Priced at \$3,495,

BRIEFS

MONITORS AND ACCESSORIES

IDEK's MF-8317 (\$1,595) is a micro-processor-controlled 17-inch color monitor with a .26-mm dot pitch, supporting resolutions of up to 1,280-by-1,024. 215-957-6543; fax, 215-957-6551

NoRad is shipping UltraGlass (\$139 Universal Model, \$149 Form Fit Model), an anti-radiation and glare shield for monitors. 800-262-3260, 310-395-0800; fax, 310-458-6397.

Polaroid is shipping the CP-60 (\$52.50) and CP-60SC (\$74.95), two new circular polarizer antiglare filters for computer monitors. The new filters are available in three sizes, and fit displays ranging in size from 9 to 15 inches. 800-225-1618, 617-577-2000

Presenta Technologies is shipping the DM-2060 (\$1,795), the company's 20-inch SuperVGA autoscanner noninterlaced monitor. The unit has a .31-mm dot pitch and offers a maximum resolution of up to 1,024-by-768. 818-960-0420; fax, 818-960-0430.

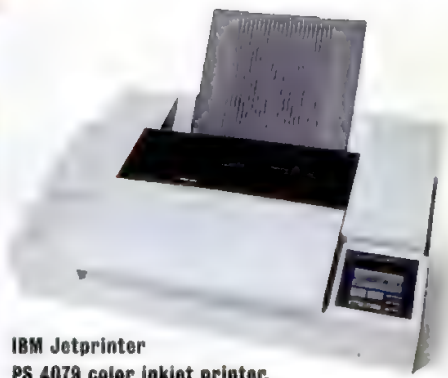
Sigma Designs has introduced the Ergo View family of color monitors. The Ergo View 17 (\$1,499), a 17-inch color monitor, supports workstation resolutions for true-color and prepress applications of up to 1,280-by-1,024, and refresh rates up to 120Hz. The unit has a .25-mm aperture grille pitch, and works with both PCs and Macintoshes.

The Ergo View 15 (\$949), a 15-inch flat-square color monitor, has a maximum resolution of up to 1,280-by-1,024 and refresh rates up to 120 Hz.

The Ergo View 14 (\$649), a 14-inch color monitor, has a maximum resolution of up to 1,280-by-1,024 and refresh rates up to 120 Hz. The unit has a .25-mm aperture grille pitch. 800-845-8086, 510-770-0100; fax, 510-770-2640

PRINTERS AND ADD-INS

Epson America has added two new 9-pin dot matrix printers to its FX line. The FX-870 (\$499) supports a paper



IBM Jetprinter PS 4079 color inkjet printer.

the color ink jet printer ships with a version of PostScript-compatible software, jointly developed by Lexmark and Phoenix Technologies. It has 360-by-360-dot-per-inch output resolution and uses Lexmark's ColorGrade enhanced screening, producing 144 levels of color. Four ink cartridges (cyan, magenta, yellow, and black) provide four-color process printing. It is Pantone-licensed for color matching and ships with 35 Type 1 scalable fonts.

The IBM Jetprinter is designed to be shared. With an optional Y cable, three ports can be active simultaneously: parallel, serial, and LocalTalk. It ships in standard configuration with 4MB RAM (upgradable to 16MB) and a paper tray that accommodates media from envelopes to 11-by-17-inch paper.

- **List price:** *IBM Color Jetprinter PS 4079*, \$3,495. *Lexmark International Inc.*, 740 New Circle Rd. NW, Lexington, KY 40511; 800-358-5835, 606-232-2000; fax, 800-522-3422.

Circle 408 on reader service card

IMPROVED

Procomm Plus Network Version Gains Protocols, Emulations

Datastorm Technologies is shipping Procomm Plus Network, Version 2.0, which contains 15 new file transfer protocols, including ZModem and ASCII. Several terminal emulations have been added, bringing the total to 33. Procomm Plus's Dialing Directory now supports higher transfer rates and has several new commands, including "Add" (for adding a new entry) and "Sort" (for sorting directory entries in one of five ways). The ASPECT script language has gained more than 100 new commands, and full 132-column support and mouse support has also been added.

Procomm Plus Network supports asynchronous communications servers from a number of different vendors, including Novell, Network Products Corp., Banyan Systems, and IBM. It supports the BAPI, IBM ACSII, IBM EBI, NASI/NCSI, and NETCI asynchronous communications server interfaces.

- **List price:** *Procomm Plus Network, Version*

Borland's

Get an extra 2 hours out

dBASE gets the job done faster

Recently, Usability Sciences, the leading productivity research firm, conducted tests comparing dBASE IV® with FoxPro. For everyday tasks like creating reports, browsing, linking, and using linked data, dBASE® users got their work done 25 percent faster.

The secret to "user-ability"

The Control Center makes complex tasks easy, and simple tasks automatic. Unlike the competition, dBASE is not merely a developer's tool. For those who are developing custom applications, the dBASE language sets the standard for power and productivity. But it's the dBASE Control Center that makes dBASE a favorite among



**FoxPro:
109
minutes**

**dBASE:
82
minutes**

dBASE takes less time to get the job done.
In independent tests using both dBASE and FoxPro, users got their work done 25 percent faster with dBASE. That's like getting an additional two hours of work done every business day. Now that's productivity!

all users. You don't have to learn the dBASE language before putting the power of dBASE to work for you.

Intuitive tools eliminate guesswork

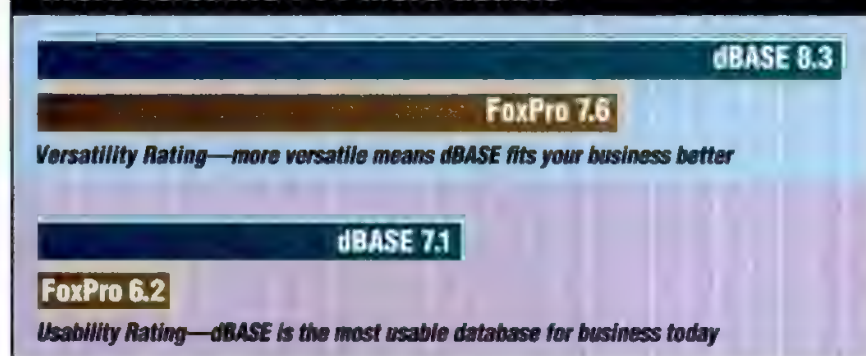
The dBASE Control Center puts you in charge, with the power to see and access everything at a glance. Its straightforward, task-oriented interface gives you single-keystroke or mouse-click access to dBASE's power. So you can perform all your daily tasks without ever seeing a dot prompt (unless, of course, you want to). And the Control Center's open architecture makes it easy to enhance or customize your own dBASE applications by incorporating third-party add-on products. No wonder NSTL rated dBASE tops in versatility and usability.* And why *ComputerWorld* ranked dBASE the #1 PC development tool for DBMS client/server software.

Get results fast

Powerful Design Tools let you create database tables, queries, data entry forms, reports, labels, and applications interactively. So you can see the results onscreen as you work.

Versatile Report Writer gives you the widest choice of report styles available, with many text enhancement features to add clarity to your data.

More versatile . . . more usable



*NSTL found dBASE to be the favorite of both novice and experienced users alike in Overall Usability and Versatility.**

dBASE IV

of every business day!

I/S prefers doing business with dBASE

	Borland dBASE	Microsoft® FoxPro
Installed in Company	#1	#5
Best Technology	#1	#4
Best Price/Performance	#1	#3
Best Service/Support	#1	#5
Best Documentation	#1	#4
Prefer to Do Business With	#1	#4
Plan to Buy	#1	#4

Source: 1992 ComputerWorld I/S Brand Preference Study

The latest **ComputerWorld** Preference Studies show dBASE outranks the competition in 12 out of 14 categories.

Easy Label Designer includes formats for mailing labels, name badges, even Rolodex cards. You name it—you're only a few keystrokes or mouse clicks away from having it on your desk.

The world's #1 database keeps getting better

New dBASE IV comes complete with pull-down menus and mouse support, so you're never more than a click away from your data.

IQ!™ technology, dBASE's exclusive Index Query optimizer, finds the fastest way to get the answers you want from your database—automatically—even in the most complex network environments. Our relational Query By Example lets you manipulate your

data quickly and easily. All you have to do is select the fields you want, and presto—instant results!

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Even novice users can create custom solutions with dBASE. When you're finished designing your database tables, labels, and reports, tie them all together as a complete application with dBASE's easy-to-use Application Generator. And you do it all without programming! Keeping track of your data and putting it to work for you has never been easier.



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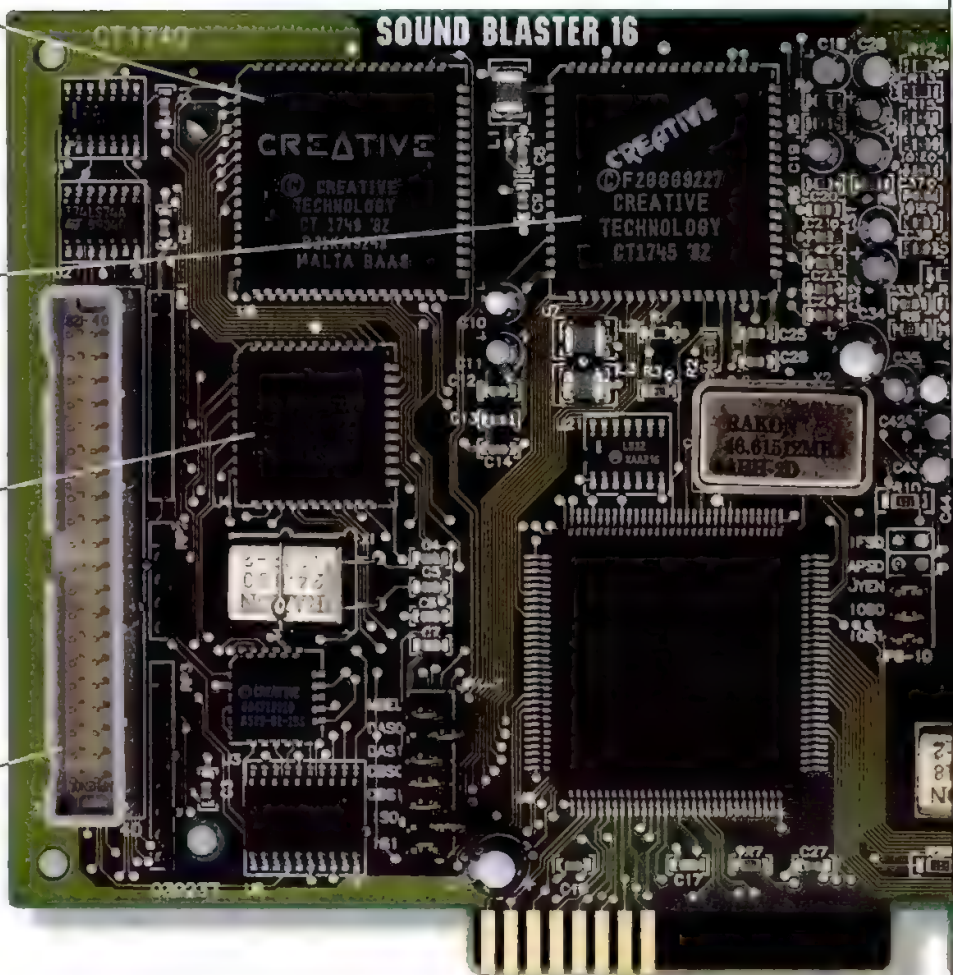
B O R L A N D
Software Craftsmanship

Advanced Signal Processing (ASP) delivers 4:1 realtime hardware data compression and saves up to 65% of CPU processing time. Downloadable algorithms enable future upgrades like voice recognition, time-based modification and special effects.

Enhanced Features include programmable mixer, multiple-source recording, treble and bass controls.

Full Sound Blaster Compatibility with an installed base of over 2 million Sound Blasters and thousands of software programs.

High Performance CD-ROM interface.



Sound Blaster 16 ASP. We're

Sure, games are great. But with new applications ranging from voice recognition to full-blown integrated multimedia, it's time to get serious about PC audio. With Sound Blaster™ 16 ASP™

The 16 ASP has all the features you'd expect on a professional-quality sound board. Like 16-bit audio record and playback. And a 20-voice stereo FM musical synthesizer. A sophisticated programmable mixer with separate treble and bass controls. Plus more than \$500 in bundled software...not bad, considering the entire package retails for just under \$350.

But the real secret to the Sound Blaster 16 ASP is Creative Labs' exclusive Advanced Signal Processing

16-BIT AUDIO CARD COMPARISON CHART

	SOUND BLASTER 16 ASP	MICROSOFT SOUND SYSTEM FOR WINDOWS	MEDIA VISION PRO AUDIO SPECTRUM 16
ADVANCED SIGNAL PROCESSOR	YES		
HARDWARE 16-BIT ASP COMPRESSION	YES		
CD-ROM INPUT	YES		YES
JOYSTICK INPUT	YES		YES
FM SYNTHESIS	YES	YES	YES
OPTIONAL WAVE TABLE SYNTHESIS	YES		
MIDI INTERFACE	YES		YES
INTEGRATED MICROPHONE	YES	YES	
COMPATIBILITY:			
DOS	YES		YES
WINDOWS 3.0, 3.1	YES	YES	YES
OS/2, WINPN/2	YES		YES
MPC	YES		YES
SOUND BLASTER COMPATIBLE	YES		YES
RESRP*	\$349	\$289	\$299

*Manufacturer's Suggested Retail Pricing provided for comparison purposes. Actual retail price may vary.



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Cross Platform Support ensures all functions are accessible from DOS, OS/2, Windows or MPC.

Bundled Software includes more than 10 valuable titles like HSC Interactive,[™] PC Animate Plus,[™] WaveStudio[™] and Talking Scheduler.[™]

State-of-the-Art 16-bit Codec with 90 dB signal-to-noise ratio.

More Inputs than other 16-bit boards, including MIDI, joystick and multiple audio sources.

Easy Installation with software-programmable interrupts and DMA channels.

not playing games anymore.

technology: realtime hardware data compression that delivers full CD-quality stereo at a fraction of the CPU power required by other 16-bit boards. It's a revolutionary new standard in both sound quality and processing efficiency.

Speaking of great sound, Sound Blaster 16 ASP uses the same 90 dB Codec sound chip as professional DAT and CD machines. So it delivers up to 12% more dynamic response and 15% better signal-to-noise ratio than other 16-bit cards.

For ultimate musical quality, you can add the optional Wave Blaster[™] daughter board and bring next-generation Wave Table Synthesis to PC MIDI.

So if you thought the original Sound Blaster set the standard for games, you're right. But the 16-bit PC Sound Barrier has now been broken. With Sound Blaster 16 ASP: the new Sound Standard for CD-quality PC Audio.

For more information, call: 1-800-998-LABS.



2.0, 5-user pack, \$215; additional workstations, \$43. Datastorm Technologies Inc., P.O. Box 1471, Columbia, MO 65205; 800-326-4999, 314-443-3282; fax, 314-875-3063.
Circle 409 on reader service card

IMPROVED

Silver Oak Systems Unveils Security/Antivirus Program

Silver Oak Systems is shipping a DOS and Windows network security and antivirus program that has access control, dual-algorithm encryption, boot protection (preventing unauthorized booting of a PC from a floppy disk), file purging, and keyboard locking of unattended PCs. IronClad, Version 2.0 (the new version of the company's DiskManagerPC), offers network-related features including piracy prevention and the ability to perform multiple security setups. The program can also designate multiple user classes, such as Superusers (who have the ability to reconfigure the program and are not subject to security features), Recognized users (with an ID and password), and Public users, who are given limited access and do not need to log on to the system.

IronClad 2.0 employs a "closed execution" antivirus strategy: Applications that are not contained in the IronClad database cannot be executed from any source, including disks, removable drives, or CD-ROM drives, according to the company.

• List price: *IronClad, Version 2.0*, \$195. *Silver Oak Systems Inc.*, 8209 Cedar St., Silver Spring, MD 20910; 301-585-8641; fax, 301-588-6484.
Circle 410 on reader service card

NEW

Lava Accelerator Board Features Three Coprocessors

Lava Computers' Lava Nova True-Color is a 24-bit graphics accelerator board capable of displaying 16.8 million colors at resolutions of up to 1,024-by-768, interlaced and noninterlaced. What makes the Nova True-Color unique is that it employs three 8514/A coprocessors and ships in standard configuration with 3MB of VRAM. It has standard software drivers for Windows 3.x; AutoCAD 12; and OS/2 2.0. It has a VGA pass-through connector for VGA compatibility, offering single or dual monitor configurations.

• List price: *Lava Nova True-Color*, \$1,495. *Lava Computers MFG Inc.*, 28A Dansk Ct., Rexdale, Ontario, Canada, M9W 5V8; 416-674-5942; fax, 416-674-8262.

Circle 411 on reader service card

BRIEFS

PRINTERS AND ADD-INS

width of 80 columns, and the FX-1170 (\$699) supports a wide-format width of 136 columns. Both units offer print speeds as fast as 380 characters-per-second in SuperDraft mode. The units support a variety of paper-handling features and include a 24K buffer, and they are compatible with the Epson ESC/P and IBM Proprinter II. 800-922-8911.

NEC Technologies has unveiled the Silentwriter Model 97 (\$2,149), a 10-page-per-minute PostScript language printer. The unit is equipped with parallel, serial, and AppleTalk interfaces, Adobe PostScript Level II and PCL 5 emulation. 800-388-8888, 508-264-8000; fax, 508-366-6476.

Samsung Electronics America has announced the Protege 5000 (\$1,295), which incorporates the company's proprietary 5-page-per-minute engine and Intel's 16-MHz i960 RISC processor. The Protege unit uses a True-Type rasterizer, along with Type 1 and Type 3 font compatibility, to ensure compatibility with Microsoft Windows 3.1. 800-446-0262, 201-229-4000.

General Parametrics has announced the Spectra Star Q10 (\$4,999), Q40 (\$6,799), and Q50 (\$13,798) color thermal printers. All three units provide 300 dpi color printing and use a 20-MHz Intel 80960 RISC processor, 10MB RAM, 52 Type 1 fonts, Pantone-certified color matching, and PostScript Level 2 compatibility. The Spectra Star Q40 has an internal 40MB hard disk for font storage and print spooling. The Spectra Star Q50 has an internal 40MB hard disk and a 35mm color SlideMaker film recorder. 510-524-3950; fax, 510-524-9954

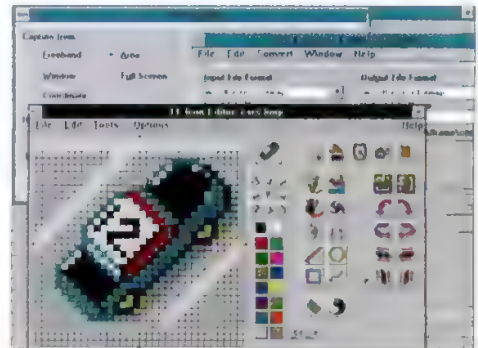
Brother International Corp's Office Systems Division has announced the HL-10PS (\$2,395), a 10-page-per-minute, 300 dpi, PostScript desktop laser printer based on Texas Instruments' 60-MHz 34010 processor. The unit ships with 37 resident fonts, and provides automatic inter-

NEW

FreezeFrame Offers File Conversion, Screen Capturing

DeltaPoint's first entry into the Microsoft Windows graphics utilities market, FreezeFrame for Windows, Version 1.0, has file conversion, file viewing, printing, screen capture, and icon editing capabilities, along with a collection of clip-art and Windows wallpaper. The program converts nearly 20 bitmaps (DOS, Windows, OS/2, Macintosh, and SUN), 15 vector, and 9 fax formats, and lets you view and print multiple files on-screen. File conversions can be performed in the background, and image control options such as sizing, resolution mapping, and color reduction are available during vector-to-bitmap conversion.

The screen-capture utility supports .BMP, .DIB, .DDB, .GIF, .PCX, .RLE, TIFF and compressed TIFF, .WPG, and Clipboard formats for editing. An Icon Editor utility lets you cus-



FreezeFrame supports many formats.

tomize icons and cursors for any Windows application. You can extract and modify icons from existing .ICW, .EXE, .DLL, .IL or .DRV format files. Fifty predefined icons and five cursors ship with the program.

• List price: *FreezeFrame for Windows, Version 1.0*, \$89.95. *DeltaPoint Inc.*, 2 Harris Court, Suite B-1, Monterey, CA 93940; 800-446-6955, 408-648-4000; fax, 408-648-4020.

Circle 412 on reader service card

IMPROVED

MICA Gains Financial Snapshot View, Customized Menus

MICA Accounting Software is shipping MICA IV, Version 2.0, an update of its DOS-based integrated accounting system, featuring a Financial Snapshot screen that displays summary information from all installed modules. Customizable menus allow the interface to be tailored to individual users and provide ac-

The new PacificPage® PE/XL. Switching to PostScript® has never been easier.

AUTOMATIC POSTSCRIPT AND PCL LANGUAGE SENSING AND SWITCHING.

We want to make your life easier. To do it, we've added autosensing and switching to our latest release of PacificPage® PE/XL for the LaserJet® IIP, IIP Plus, III, IIID, and IIIP. What it does is eliminate the inconvenience associated with manual switching between PostScript and PCL languages. It's especially useful to users of networked LaserJet printers or individuals who send both PostScript and PCL files to their printer. No special software, drivers, PC boards or special cables are required.

PacificPage PE/XL is easy to use, but it's also fast. The accelerator board utilizes an Intel i960 processor for output up to 8 times faster than any other cartridge. And our new automatic interface switching feature allows users to simultaneously use all interface ports.

PacificPage PE/XL includes 35 fully scalable typestyles and is compatible with all Windows and DOS software programs that support PostScript. All you need to do is slip the cartridge and accelerator board into the printer, select the standard PostScript driver, and you're ready to print!

Pacific Data Products offers a full lifetime warranty, free technical support, convenient upgrade programs, and of course, our 60 day money-back guarantee of satisfaction.

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Typestyles:

Courier Swiss 721 (Helv) Swiss 721 Narrow (Helv Narrow)
Dutch 801 (Tms Rmn) Zapf Calligraphic 801 (Palatino)
ITC Avant Garde® ITC Bookman® Century Schoolbook
ITC Zapf Chancery® ITC Zapf Dingbats® Symbol αβγδ

Each typestyle comes in normal, bold, italic and bold italic treatments except for Chancery, Zapf Dingbats, and Symbol.

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- 100% PostScript compatibility guaranteed
- Automatic PostScript and PCL language sensing and switching on the printer
- Record Speed! Uses the Intel i960™ RISC processor
- Automatic interface switching - lets everyone use the printer
- 4 MB of memory included

cess to other programs from MICA's Main Program Menu. Additional features include a Notes function, a Quick Check option that lets you print a check when entering an invoice in the Accounts Payable module, and automatic calculation of your UPS freight charges.

As with previous versions, MICA IV 2.0 includes general ledger, accounts receivable, accounts payable, inventory control, payroll, job cost, sales order, purchase order processing, and bank reconciliation functions.

• **List price:** *MICA IV, Version 2.0, each module, \$795; upgrade from Version 1.0, \$150 per module. MICA Accounting Software, 2349 Memorial Blvd., Port Arthur, TX 77640; 800-448-6422, 409-983-2051; fax 409-983-5106.*

Circle 413 on reader service card

NEW

HyperWrite 1.0: The Hypertext Word Processor for Windows

Looking Glass Software's HyperWrite 1.0 for Microsoft Windows lets you create and play back full-color hypertext presentations and do word processing. The \$149.95 program's hypertext editing features let you hyperlink characters, words, paragraphs, and entire documents. You can place bookmarks, annotate occurrences of specified characters and phrases, and index documents. Imported graphics and sound may be attached to documents, and the program is compatible with most popular Windows word processors and graphics packages.

HyperWrite is WYSIWYG and includes a 100,000-word spelling dictionary and spell-checker, various formatting features, and standard cut, copy, paste, and drag-and-drop capabilities across documents and other applications.

• **List price:** *HyperWrite 1.0 for Microsoft Windows, \$149.95. Looking Glass Software Inc., 11222 La Cienega Blvd., #459, Inglewood, CA 90304; 310-348-8240.*

Circle 414 on reader service card

NEW

Add-in Boosts HP LaserJet Series II, III to 600 dpi

Call it dots-per-inch desire. HP LaserJet Series II and III owners are attracted to the 600- by 600-dot-per-inch resolution of the new HP LaserJet 4, but don't necessarily want to junk their existing units. Thus, **Laser Printer Accessories Corp. (LPAC)** has unveiled the \$595 doubleRES IV add-in card,

BRIEFS

PRINTERS AND ADD-INS

face switching. Brother's own BR-Script PostScript Language Interpreter and High Resolution Control, automatic emulation switching, and data compression. 908-356-8880; fax, 908-356-4085

QMS has unveiled the QMS 1725 (\$5,995), a 17-page-per-minute laser printer based on the company's proprietary Crown advanced document processing technology. The multinetwork unit (which provides serial, parallel, LocalTalk, and optional Ethernet or Token-Ring interfaces) offers job spooling, font management, and PostScript Level 2 emulation. The QMS 1725 has user-selectable print resolutions of 300-by-300 dpi and 600-by-600 dpi, and ships in standard configuration with 8MB RAM (expandable to 32MB). 800-631-2692, 205-639-4400.

Digital Equipment Corp. has announced its first PostScript Level 2 laser printer, the DECLaser 1152 (\$1,299), which employs Canon's LBP-LX 4-page-per-minute print engine and Motorola's 16-MHz 68000 processor. The unit ships in standard configuration with 2MB RAM, 17 scalable fonts, and Adobe Systems PostScript Level 2 and Hewlett-Packard's PCL 4 page-description languages. Compatible with PCs and Macintoshes, the DECLaser 1152 provides 300-by-300-dpi resolution, and includes one serial, one parallel, and one AppleTalk port. 800-344-4825; fax, 800-234-2298.

ASP Computer Products has unveiled ServerJet (\$395), a printer-sharing device that plugs into the MIO (Modular I/O) slot of the LaserJet 4 and allows up to 10 users to share a single printer. ASP has also introduced the JetLAN Novell/Ethernet print server (\$695), which plugs into the MIO slot, turning the unit into a standalone print server on any Ethernet network that is running Novell NetWare. JetLAN supports the MIO protocols, allowing users to program functions such as "Job Offset" directly from the printer's control panel. 800-767-8004.

which fits into the optional I/O port on the back of the LaserJet II and III, and boosts printer output resolution to 600- by 600-dpi. The doubleRES IV card also employs its own Windows driver, increasing printing speed. According to the company, the driver uses a proprietary data compression technology, which compresses text and graphics (including fonts) in 600-dpi resolution. The driver sends the data to the card, which decompresses the data and sends it to the printer engine. Windows 3.x users have access to all the features of Windows printing, including embedded and downloaded TrueType Fonts. The card also supports Adobe PostScript Type 1 and Type 3 fonts.

• **List price:** *doubleRES IV, \$595. Laser Printer Accessories Corp., 10865 Rancho Bernardo Rd., San Diego, CA 92127; 619-485-8411; fax, 619-487-5809.*

Circle 415 on reader service card

IMPROVED

Plustek USA Rolls Out Sheet-Fed 24-Bit Color Scanner

Plustek USA's \$899 ScanPlus Color 6000, the successor to the company's Color 3000, offers improved output resolution of 600 dots-per-inch, increased scanning speed, enhanced color capabilities, and a redesigned brightness control that resides in the software. The Twain-compatible unit, which does single-pass scanning, now fully emulates Hewlett-Packard's HP ScanJet IIc driver, ensuring compatibility with most Image, Desktop Publishing, and OCR (Optical Character Recognition) software, according to the company.



The Color 6000
provides single-pass scanning.

The ScanPlus Color 6000 has three scanning modes: Black and White/ Halftone, Gray (up to 256 gray scales), and 24-bit color. The scanning area accommodates images ranging in size from 2 by 3.5 inches to 8.5 by 14 inches.

• **List price:** *ScanPlus Color 6000, \$899. Plustek USA Inc., 3350 Scott Blvd., #46, Santa Clara, CA 95054; 800-685-8088, 408-980-1234; fax, 408-980-5184.*

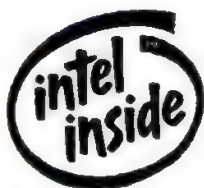
Circle 416 on reader service card

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Amazing
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I N T R O D U C I N G N E C

A Lot Of Extra Bang



NEC PowerMate® 425
NEC MultiSync® 3FGx™ Monitor
Pre-loaded Microsoft Windows 3.1
486/25MHz, 8MB RAM, 120MB hard drive,
1.44MB floppy drive, 1MB video RAM (1024 x
768), integrated fax/modem (9600 bps), Norton
Utilities, Microsoft mouse, mousepad, 101-key
keyboard, DOS 5.0, remote "co-session" support

\$1,999

Why settle for an ordinary PC when, for the same price*, you can have an NEC Select Solution™ system?

Every NEC Select Solution gives you the quality of an NEC system, the convenience of **NEC SELECT SOLUTIONS** pre-loaded, optimized Microsoft® Windows™, and the performance of a world-renowned NEC MultiSync monitor.

We've made Windows faster and easier than ever.

The first benefit of ready-to-run Windows is that you don't have to install it. But that's just the beginning. Through a strategic partnership with Microsoft Corporation, we've developed a method for optimizing Windows 3.1 that actually makes Windows computing not only easier but up to **20% faster** as well.

For example, the NEC custom Windows Program Manager (like the one at left) organizes the applications that work together into logical groups. An Information Center group provides quick answers to your questions and includes ReadMe files for your system and your applications.



We also streamline your application parameter files by removing unnecessary drivers and filters. And all NEC Select Solutions include the Visual Basic™ Library, allowing you to run any Microsoft Visual Basic program.

*Based on an approximation of industry-average system prices and the cost of system set-up. **On-site service may not be available in certain remote areas. NEC® and PowerMate® are registered trademarks, and Select Solution™, FG™, Image™, ImageSync™, and Express™ are trademarks of NEC Corporation and its affiliates. All other product, brand, trade names, registered trademarks, or logos used in this publication are property of the respective trademark owners.

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To maximize Windows 3.1 performance, we fine-tune many of its features: FastDisk is enabled; the system swap file is positioned for fastest access; memory interleaving is optimally sized; and your hard drive is fully optimized for maximum performance. It's Windows like you've never seen it before. And it's standard on every NEC Select Solution.

Outstanding performance from NEC monitors and CPUs.



Every one of our NEC Select Solutions includes an NEC MultiSync FG™ color monitor, widely recognized as the industry's best.

Our monitors would be great with any PC, but they perform even better with our PowerMate®, Image™, and Express™ series computers. NEC's unique ImageSync™ feature enables our PCs to adjust the display on a MultiSync monitor so that it operates at the maximum refresh rate. The result is integrated performance you can't get anywhere else, at any price.



Want to network? Just ask us.

Every NEC Select Solution is available with network boards and Novell® drivers installed and configured to get you connected in no time. When you call, we'll be glad to discuss your individual networking requirements.



NEC PowerMate 433
NEC MultiSync 3FGx Monitor
Pre-loaded Microsoft Windows 3.1
 486/33MHz, 8MB RAM, 240MB hard drive, 1.44MB floppy drive, 1MB video RAM (1024 x 768), integrated fax/modem (9600 bps), Norton Utilities, Microsoft mouse, mousepad, 101-key keyboard, DOS 5.0, remote "co-session" support

\$2,499



NEC PowerMate Express DX2/66
NEC MultiSync 3FGx Monitor
Pre-loaded Microsoft Windows 3.1
 486DX2/66MHz, 8MB RAM (expandable to 256), 240MB hard drive, 1.2 and 1.44 MB floppy drives, 128KB cache, 5 EISA expansion slots, Microsoft mouse, mousepad, 101-key keyboard, DOS 5.0, tutorial software

\$4,129

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REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Carol Levin

Now That I've Got OS/2 on My PC, What Next?

BY JOE SALEMI

You could start by getting to know the new object-oriented Workplace Shell (WPS) in OS/2 2.0, then tuning your DOS and Windows sessions and learning some shortcuts. Though many of the new books on OS/2 cover application development, these three end user books will guide you through the operating system before you go off exploring on your own.

Van Nostrand Reinhold stands out among publishers, with a series of nine books on OS/2 including programming and database development books as well as a tutorial and guide on WPS basics.

Now That I Have OS/2 2.0 On My Computer, What Do I Do Next? is written for those who have little or no experience using a GUI and assumes that OS/2 is alive and well on your machine. Authors Steven Levenson and Eli E. Hertz use a tutorial approach to explain OS/2's four object types—devices, folders, data files, and programs. Building on these concepts, they show you how to manage the desktop's main icons, use the massive on-line help system, and customize the desktop. By following clear and precise instructions, you can step through the process of moving and copying objects and creating "shadows" or duplicates.

The second half of the book covers the bundled applets, with an entire chapter on PM Chart—

OS/2's poorly documented presentation graphics applet. The book is loaded with examples of OS/2 screens and plenty of keyboard shortcuts. An appendix lists all the files on the 21 installation disks, making it easy to figure out which disk has the printer drivers you may need. But there are also some page-fillers: a chapter on the OS/2 word processor Describe and a fairly technical essay on the advantages of OS/2 over Windows.

As a supplement to the booklets that come with the software, *Now That I Have OS/2* is ideal for distributing to users when OS/2 is first installed. If you're comfortable with GUI concepts, you're better off with *Using OS/2 2.0* by Barry Nance and Greg Chicares. The first of five sections is an overview of computer concepts, followed by two introductory chapters—one for those who've never used DOS, and one for users moving to OS/2.

A complete guide to installation follows, with recommendations for each setting and separate chapters on configuration and troubleshooting. There are some details on customizing the desktop, though not as comprehensive as the VNR book.

Next you'll find details on using the WPS, OS/2 objects, the on-line tutorial and help system, the Enhanced Editor, and the print

spooler. A brief chapter explains how to run DOS and Windows applications, with tips on optimizing these sessions.

The balance of the book has a complete reference guide to over 100 commands you can use at the command line and an appendix of examples and recommendations for each CONFIG.SYS command. Keyboard shortcuts, commands, and mouse instructions for common tasks are on the inside covers.

It's obvious that the authors did their homework and consulted system designers and beta testers; the best feature is the collection of tips and tricks on getting the best performance from OS/2. The combination of practical information and tips makes *Using OS/2* the best choice for most users.

If you need a more technical look at OS/2, you'll want *Inside OS/2 2.0* by Bill Camarda, John W. Little, Mark Minasi, and Marlene Semple. Though you'll find much of the same information in *Using OS/2*, including a number of tips and tricks on tuning OS/2 and the WPS, the extensive information on optimizing DOS and Windows sessions makes *Inside OS/2* stand out. In particular, the chapter on DOS sessions details over 30 different settings with advice on how to tune them. Windows coverage is less extensive because there's quite a bit of overlap between Win-OS/2 and DOS sessions.

There's also plenty of information on connectivity features such as using OS/2 on LANs or as a terminal to minicomputers

and mainframes. There's even a brief mention of OS/2's client/server database capabilities.

Another unique feature is a chapter on REXX—IBM's extensive batch and command control language—with numerous examples of variables, loops, and math functions. Like *Using OS/2*, *Inside OS/2* has a guide to installation and a reference to OS/2 commands (without the details on CONFIG.SYS). There's also a survey of OS/2 applications.

Inside OS/2 presents such extensive information on tuning OS/2 that it's really aimed at power users. It's also a good reference manual for technical staff who need to support their OS/2 users.

In short: For an easy overview of the WPS, go with the VNR book; *Using OS/2* is the best comprehensive guide; and for extensive fine-tuning, *Inside*

OS/2 should keep you busy. □

• **Now That I Have OS/2 2.0 On My Computer, What Do I Do Next?**, by Steven Levenson and Eli E. Hertz, \$22.95. Van

Nostrand Reinhold, 115 Fifth Ave., New York, NY 10003; 800-842-3636. ISBN: 0-442-01227-6.

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• **Using OS/2 2.0**, by Barry Nance and Greg Chicares, \$24.95. Que, 11711 N. College Ave., Carmel, IN 46032; 800-428-5331. ISBN: 0-88022-863-6.

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• **Inside OS/2 2.0**, by Bill Camarda, John W. Little, Mark Minasi, and Marlene Semple, \$34.95. New Riders Publishing, 11711 N. College Ave., Carmel, IN 46032; 800-428-5331. ISBN: 0-56205-045-1.

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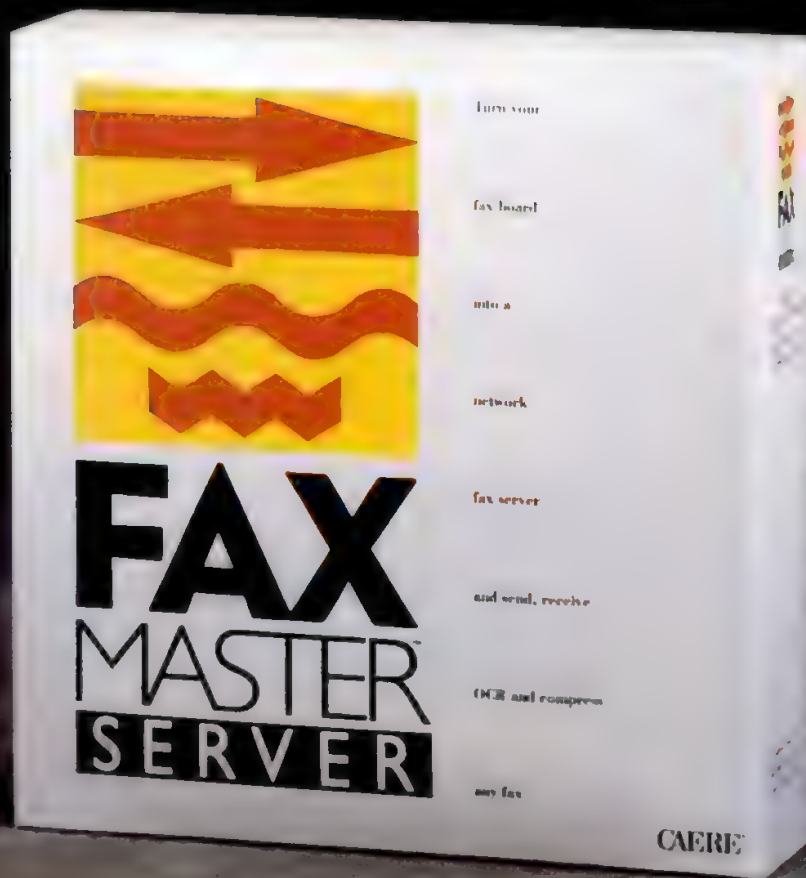
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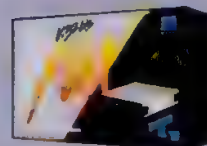


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Edited by Trudy Neubaus

VMData Frees You from Memory Management Tasks

BY RICK KNOBLAUGH

If your programs regularly load large amounts of data into memory, and you loathe the overhead of manipulating extended and expanded memory, you should consider adding VMData to your tools. VMData, published by Pocket Soft, is a library of data management functions that enable your programs to swap data into and out of various memory locations and disk areas, and free you from writing special memory management routines. VMData also insulates your programs from dealing directly with the memory allocation methods of various platforms. To have your code run on a different platform, just purchase the library for that environment and use it when compiling. VMData libraries are available for MS-DOS (2.10 or later), Windows (3.0 and 3.1), and OS/2 (1.x). According to Pocket Soft, support for OS/2 2.0 should be available by the end of 1992.

HOW VMData WORKS

VMData organizes available memory into 2K pages. It first looks for available memory in UMBs, then in locked EMS (addressable memory in the EMS page frame), and finally in conventional memory. If it finds space in these areas, it will use them as its main storage areas. If more memory is needed, VMData employs an LRU algorithm to swap the least-re-

cently used data from these areas to other areas, including the high memory area (the first 64K of extended memory), mapped EMS (EMS memory outside of the physical address space of DOS programs), and XMS (extended memory). This way, the data to which you need fastest access will be stored in UMBs, locked EMS, or conventional memory. Only when all of these memory areas are exhausted will VMData create swap files on-disk. The maximum amount of each type of memory VMData will use can easily be configured by calling a VMData function, `VMMMaxMemorySizeSet()`.

In addition to letting you read and write data in a virtual memory environment, VMData helps you organize your data for quick access. It includes support for variable- and fixed-length records, virtual memory arrays, a virtual memory pool (heap), record buffering, indexing, AVL (Adelson-Velskii and Landis) trees for keyed access, hashing functions, and sorting functions. VMData also includes optimization choices: For example, you can decide whether the VMData swapping strategies should be geared toward achieving high performance or whether they should attempt to conserve storage space.

Understanding the concepts behind these features and how to make use of them takes some

effort. The user manual thoroughly introduces each concept and shows good examples of how the various functions can be incorporated into your code. Unfortunately, some information that is crucial to successfully using the libraries, such as the required memory model (large) and recommended stack size (6 to 8K) can only be found in the on-disk documentation files.

When you use VMData for virtual memory storage, you gather related data into VMDataSets. VMDataSets have many of the same characteristics as disk files. That is, VMDataSets have sizes, and their records are accessed by relative position number. The process of updating data in a VMDataSet is also like updating data in a disk file.

To update a disk file, you must first read it into a buffer, update the data, and write it back to disk. To update data in a VMDataSet, you request a piece of data via one of the VMData functions such as `VMRecordGetByPos()`. The data then becomes available in addressable memory and its associated page is locked into place. When you are finished with the data, it will be "released." The data will no longer be available at the same address and VMData may move the page around in its various swapping areas.

If you update the data, you must indicate to VMData that you have done so—in one of two ways. You can either set an attribute, which makes VMData assume that all accesses to a particular VMDataSet result in data being changed, or you can call `VMRecordChanged()`. Requiring you to indicate if data has changed lets VMData be that much more efficient. For example, if

VMData knows that data within a given page—which also exists in a swap file—has not been altered, it won't update the page within the swap file.

If data has been updated and you haven't set an attribute, you must call `VMRecordChanged()` before the data is released. Data is either released implicitly on the next VMData function call to retrieve data, or you can explicitly call `VMRelease()` to release the committed item.

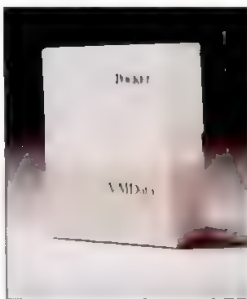
When you're ready to link your program, you can use one of two VMData libraries: a debug library or a production library. The debug library supplies parameter validity checking, flags that can be set to enable internal VMData checks, routines that you can call to verify data structures, and data structures that you can load to facilitate generating break points on memory page accesses. You should use the production library for the final version of your product.

In short, if you often need to manipulate large amounts of data necessitating the use of swapping to EMS memory, XMS memory, or disk, you should seriously consider VMData—especially if your software will be ported to other environments such as Windows. VMData provides powerful, portable virtual memory management capabilities that are sure to enhance your development efforts. □

• VMData, Version 1.0

List Price: \$495 for first OS platform purchased, \$295 for each subsequent OS. Requires: DOS 2.10 or higher; EMS, Version 3.2 or later; XMS, Version 2.0 or later. Pocket Soft Inc., P.O. Box 821049, Houston, TX 77282; 800-826-8086 or 713-460-5600.

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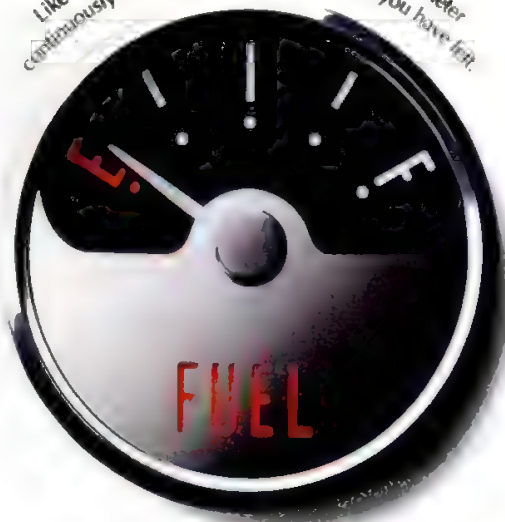


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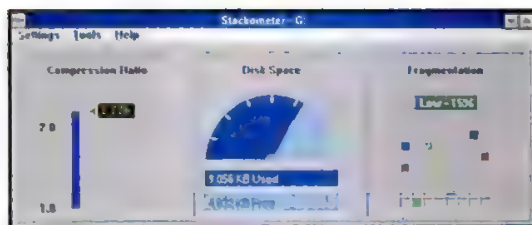


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Michael J. Miller

All Together Now

As we head into 1993, I'd like to propose one resolution for the software industry. Let 1993 be the year the industry broadens its focus from programs designed to work one at a time, for a single user, to programs that work together

with other programs and with other users.

Today most applications are huge, monolithic programs. Buy a word processor and you'll also get a spell-checker, a grammar checker, and even a drawing module. You get a lot for your money, but with the advent of multitasking (or at least task-switching) operating environments, you're much more likely to run multiple applications. As a result, it's becoming more important for programs to share data easily. Going a step further, I'd like to see programs that are able swap components so I can choose the drawing module I prefer and use it with my word processor and spreadsheet.

The industry is steadily moving toward this "object-oriented" approach to software design, but so far we've seen only a few tentative steps in this direction. At the same time, more and more users are working in networked environments. And while programs like electronic mail and multiuser databases have capitalized on network technology, most applications have not yet incorporated network features. The time is right: As we move to applications that help people work together on a network and to applications that work together on a single machine, we need to see broad acceptance of these ideas by all of the major applications.

Here are a few suggestions for reaching this goal. They sound simple but are, admittedly, difficult to implement.

1. Intelligent file sharing. Vendors need to understand that people want to share files over the network but want to do it in a reasonable fashion. In most cases that means record or page locking, not file locking, and read-only access even when a record is locked. It means identifying those users who have the locks and, identifying who has made changes in a spreadsheet or word processor.

2. Understanding the "occasionally connected user."

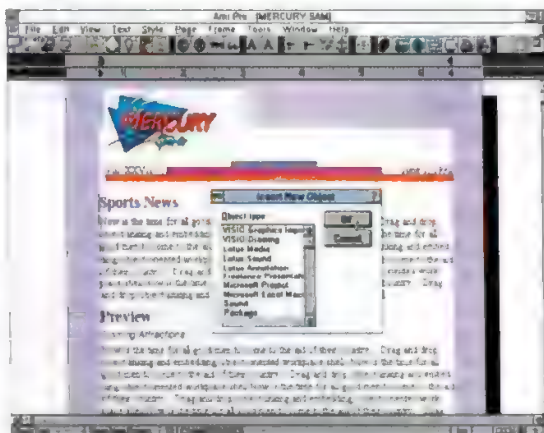
This means creating programs that don't simply lock up if the server is down and that don't get confused if they need to access information from a workstation that isn't logged on. It also means providing network software that understands that people who are connected remotely via portable computers are only logged on a relatively short period of time but need up-to-date information.

3. Reasonable network license agreements. This is getting better as more vendors are using "simultaneous access" provisions, but there's still a long way to go.

In the area of applications working together we've seen more progress, particularly among applications from a single vendor. Lotus's applications (specifically AmiPro, 1-2-3, and Freelance Graphics for Windows and for OS/2) are the most advanced at this point in terms of a common user interface and hooks to the company's electronic mail systems, but even that is far from perfect. (Notes and CC:Mail are getting closer to really working together, but they aren't there yet.) Borland, Computer Associates, Microsoft, and Software Publishing Corp. have all done some work in this area. Still, there are a lot more features we could see in the future.

4. Easy application launching.

We need applications that are able to launch and be launched by other applications, even apps from other vendors. This is relatively simple, usually consisting of an icon for the nearly ubiquitous icon bars in graphics applications, plus a simple macro. Polaris PackRat has been able to attach to Microsoft Word for Windows for years, and you can easily launch Lotus applications from each other. Look at the wonderful way applications such as WinFax Pro are able to attach themselves to nearly every



Let 1993 be the year that applications work together...for real. Here are nine steps for living up to the resolution.

Michael J. Miller

Windows application out there.

Any application that people spend most of their day in should be able to launch other applications, and most have that ability already. But the vendors of these other applications need to supply the icons and macros to launch those applications. Come on—would it be that difficult for, say, Microsoft to supply the icons necessary to launch Excel from AmiPro and WordPerfect? Or for Borland to do the same for Quattro Pro for Windows?

5. Better import and export of data. Today you can move basic spreadsheets among 1-2-3, Excel, and Quattro Pro, but formatting is problematic. The same holds true of AmiPro, DeScribe, Microsoft Word, WordPerfect, and WordStar. We can do better.

6. Open file formats. As a part of better import and export, we need open file formats. I know that software vendors like to keep their file formats proprietary so they can always make changes, improve performance, and add features. But it's our

data in those formats, and we need to be able to get it out from any application we want to use.

7. Cooperation in messaging standards. We need more applications to support more messaging formats. The current situation, where Lotus applications only work directly with CC:Mail and Notes, and Microsoft applications only work with MS Mail, is just plain silly and shortsighted. The industry doesn't need a debate about whether the Vendor-Independent Messaging (VIM) standard endorsed by Lotus, Apple, and their friends is right, or whether vendors should support Microsoft's Mail API (MAPI). What we need is a way for these two "standards" to work together.

There are workarounds to these problems, such as custom or third-party macros for Word that call CC:Mail, but you would expect all the major applications developers to support all the major electronic mail systems. WordPerfect is setting a good example here: Despite the fact that it offers its own electronic mail product, it has announced its intention to make its word processor work with both VIM and MAPI. That's the right answer. Customers don't want the debate; they just want it to work.

8. Cooperation in database standards. Borland has taken a great step in that direction by announcing its plan for its Open Database API (ODAPI) to accept a drive for Microsoft's Open Database Connectivity (ODBC) standard. Now we just need more database vendors who will actually be willing to ship the code necessary for ODAPI or ODBC connectivity to work in practice.

9. DDE, OLE, and SOM. We need more applications to take advantage of the various mechanisms that the different operating environments use to share data between applications. Windows has Dynamic Data Exchange and Object Linking and Embedding (with new Network DDE and a better OLE on the way). OS/2 has DDE and the System Object Model (SOM). Macintosh has Publish and Subscribe. Most vendors are now taking advantage of these features, but there are still a few who haven't caught on.

That's my list. It isn't simple, and I don't expect it all to happen in one year. Still, if you don't have great expectations, you'll never even get close. In the meantime I'd like to wish a happy new year to all of you, and here's to better, more productive computing in '93. □

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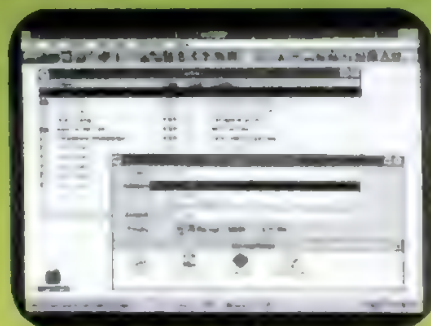
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MEDIA  VISION



Bill Machrone

Ted Williams and the GUI

The stuff that dreams are made of—not Shakespeare or *The Maltese Falcon*, but the Sears catalog. As a boy I used to pore over its pages, practically committing them to memory. My tastes were varied: tools, toys, car parts, sports equipment.

I was gangly and uncoordinated, but I dreamed of the effortless catches I'd make and the powerful hits I'd unleash with a Ted Williams—autographed glove and bat. I still remember the photo of him in the catalog, bat high over his shoulder, eyes fixed on the bleachers where he would send the next pitch.

Ted Williams was an awe-inspiring character. He was a powerful hitter and he owned the outfield, where he not only caught everything coming his way, but where his throws back to the infield were hard, fast, and flat. Sportscasters loved to tell the story of Williams's deft, talented touch and his monstrous bat, heavier than anyone else's on the team, which he could pick out of the rack by its heft alone.

Years later, when I studied psychology, I learned that Williams's great bat-picking trick was no trick at all. Everyone could discern differences among bats of as little as 15 percent and, with training, could detect differences twice as subtle—7 or 7.5 percent. True experts could differentiate between variations as close as 5 percent. Fifteen percent, it turns out, is the Just Noticeable Difference, or JND. You or I could have picked Williams's bat out of the rack with just a bit of practice.

The stuff computers are made of, silicon and software, have readily discernible differences in performance, too, but it takes a whole lot more than 15 percent to get our attention. Most of us wouldn't cross the street for a 15 percent boost in speed. We don't start to pay attention until we're looking at twice the performance, and three times would be even better. That's the increase we saw from the original PC to the AT, and from the AT to the 386.

THE GRAPHICAL LINK

Some users are still complaining about the slow-

ness of graphical user interfaces and saying they wouldn't dream of replacing their blindingly fast DOS character-mode applications with slogging graphical programs. I certainly won't contest their argument about the speed of character-mode programs, but I submit that there's a level of diminishing returns beyond which more speed doesn't help. Instant is instant. That instantaneousness is what has been missing from graphically based programs. Until now.

Today's 486DX2/66 machines, with sub-15 millisecond hard disks, tons of cache, and local-bus video make graphics programs, for the first time, instantaneous. There's no Just Noticeable Difference here, but a Blindingly Obvious Difference. You can use Windows or OS/2 with the same degree of freedom and performance as any DOS program, with all the attendant benefits of true WYSIWYG and multitasking.

I've been working with 66-MHz machines from Dell, Gateway, and Compaq, and I'm just blown away. These machines are synergistic, greater than the sum of their parts. I could run our benchmark tests and tell you that one is faster than another, but that's not the point. As a group, these machines are different from what's come

before. I've had Northgate 386/33s at home and in the office for several years. Then I started using a 486/33 in my West Coast office. It was noticeably faster than my 386/33s, but it didn't hurt to go back to the slower machines. I basically sat out the 50-MHz subgroup of machines, knowing that they were a transitory phenomenon on the way to 66 MHz. Now that I'm used to the 66-MHz machine, it's difficult to go back.

We continually refine our benchmark tests, and many of our e-mail conversations are about the performance characteris-



It doesn't take Ted Williams's discerning eye to see the power that DX2/66s bring to graphics.

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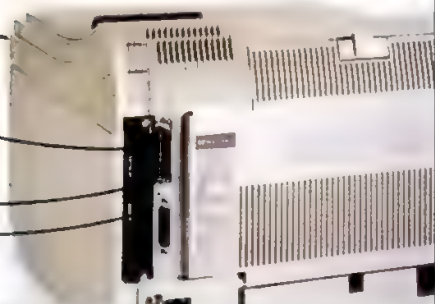
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Bill Machrone

tics of new chips, components, and drivers. I often receive messages with attached spreadsheets of benchmark test results. I usually want to see the results for myself and do some additional analysis. The speed with which I can highlight an area of interest and graph it the way I want brings a smile to my face. The combination of fast computation and coprocessing means that I can run a 256-color driver noticeably faster than I could run 16-color. Even the 65,000-color drivers are acceptably fast. That opens a whole new world of possibilities in the kinds of applications I can run and the way they look on the screen. I may be used to these machines, but I sure don't take them for granted. I've always been a fan of the theory of local-bus video, but the practice just blows me away. These are the first generation of local-bus machines. Imagine what's to come. I'm further amazed that even with the latest local-bus video, you can have these machines at license-to-steal prices.

Add a V.32/V.42bis modem and a Hewlett-Packard LaserJet 4, and you've got a system that will retain its level of competence for years. Nothing, however, stands still, least of all technology. Pentium (P5)-based machines will outperform today's machines handily; internal bus speeds will rise to 66 MHz; video will get even more aid from coprocessing; and we'll see animation, 3-D, and TV images on our screens.

THE PENTIUM PRENOQUATIVE

It's been a couple of months since Andy Grove told the world that Intel's next-generation processor, code-named P5, will be called Pentium instead of the more logical 586. The reason is that it's difficult to protect a trademark made up of numbers. Thus, you have a Mercedes 600 and a Chrysler 600. Anyone can see the difference between a Mercedes and a Chrysler, but the differences in microprocessors are much less obvious. Intel never wants to find itself again in the position of explaining the difference between its 486 and Cyrix's.

So Pentium joins the ranks of Camry, Lexus, and Retsyn with an invented name. It's supposed to connote a fifth-generation microprocessor while evoking the feeling of something elemental and strong, like titanium. To me, it sounds like a gasoline additive. Exxon (another made-up name) did fine telling us that we should have a tiger in our tanks. Intel can only hope to do as well convincing us that we need a Pentium in our processors. □

The World At Your Fingertips.

INTRODUCING A 1.3 LB. PC! SEND & RECEIVE E-MAIL AND MORE.

Imagine a portable PC that lets you send and receive e-mail, modem a memo to the home office, write reports, create spreadsheets, manage your calendar, calculate your expenses...*work non-stop for ten hours*...and is so portable that it weighs about the same as a notepad.

A futuristic fantasy? Not unless the future is now. It's the ZEOS® Pocket PC, and only ZEOS has it. You're going to love how portable and affordable it is. In fact, we think you'll find it's the one PC you'll want to take with you everywhere!

COMPACT YET COMPLETE.

At only 9 1/2" x 4 1/2" and only 1.3 lbs., what's great about the ZEOS Pocket PC is that it has a keyboard you can really use. If you're accustomed to typing with both hands, switching to a palmtop can be awkward because the keyboard only lets you type with one hand or even one finger. Yet the ZEOS Pocket PC's keyboard lets you use both hands easily, so you won't sacrifice comfort and speed for portability.

And even though it's small, the ZEOS Pocket PC carries a *full suite of industry standard software* already loaded and ready to go! You get Microsoft DOS 5.0 system files with built-in file transfer and Microsoft Works 2.0 with word processing, spreadsheet, database and communications programs. Plus, you get a personal organizer which includes a calendar/planner, "to do" list, business card file, information retrieval (for country codes, converting measurements and currency) and more. It's everything you need to manage your life!

Word processing, spreadsheet, database and communications programs...plus a personal organizer. All on an easy-to-read screen with full 80x25 character display!

YOUR LINK TO THE WORLD.

Modem a memo to a client; send and retrieve your e-mail. With the Pocket PC's optional fax/modem, you can communicate worldwide. Plus, expanding the memory is another easy option—with an additional memory card that slips right into a slot on the system's underside. And that's not all.

IT JUST KEEPS GOING...

Ten hours of continuous use? Absolutely! All it takes is the two AA alkaline batteries included with your system. And your ZEOS Pocket PC has great power management, too—it automatically switches to the suspend mode when you take a break. Plus, when you turn off your system, then turn it on again, it goes right back to where you left off. What a time-saver!

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Questions about your purchase? ZEOS technical support is 24 hours a day, 365 days a year, and always toll-free. And we back every ZEOS purchase with our 30-Day Absolute Satisfaction Money-Back Guarantee, One Year Limited Warranty and more.

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September 14, 1992

"The first mini PC with a keyboard large enough for serious typing"

—PC World

November 1992

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CIRCLE 125 ON READER SERVICE CARD

The only notebook with a tilt & swivel display. Great for sharing data or keeping it private. Easily adjusts for perfect viewing.



This fine Italian leather carrying case is an additional option. Loaded with pockets and features everyone will appreciate.



Digital brightness and contrast buttons make screen adjustment so easy.

ZEOS® Freestyle/SL. More features at a lower cost than any other notebook.

To try and compare the new ZEOS Freestyle/SL to any other notebook on the market is next to impossible. Because nothing else has all its features. And even with all these great features, nobody can match the price. Features and price. It would seem the new ZEOS Freestyle/SL is the best of all worlds. It is.

DESIGNED BY USERS. JUST LIKE YOU!

We asked our customers what it is they want in the perfect notebook. The first thing they told us is that most notebooks look like a cigar box with a lid. They told us they wanted not only good looks, but things like great power *and* great battery life. Lightweight too, like five pounds and change. And the keyboard should be effortless to use. The entire product had to be extremely durable. And that was just for starters.

SL POWER. SL BATTERY LIFE. 64K CACHE!

We listened well.

Then we got down to work. For the chipset and CPU we selected the Intel 25MHz SL. We then built in a high-speed 64K SRAM cache as standard. We know this system might well replace a desktop for many users.

And power to your ZEOS Freestyle/SL system is provided by our advanced battery system. The fully enclosed lightweight battery packs easily snap in and out and can be "quick-charged" when the system is not being used or trickle-charged when in use. So what happens when the power is on?

GREAT VIDEO TOO.

You get great video! Because for video control, we chose the amazing new Cirrus Logic VGA controller. It not only consumes less power, it also produces the fast crisp images you're looking for. And with a business machine like this you'll also appreciate our dual display capabilities. You can connect an external VGA color monitor for simultaneous co-display. And that's not all.

Period.

A NOTEBOOK KEYBOARD YOU'RE GOING TO LOVE.

We re-designed and re-sculpted every key from scratch. Even the key-switch mechanism was invented anew. And we added the mouse key for easy cursor control. It is the absolute perfect notebook keyboard. What else?

Lots else! Like the best display system of any notebook available anywhere. We listened here too. The screen is big and easy to read. Plus, it's high contrast and it's fast. It's also very easy to adjust. People said contrast and brightness knobs were hard to use. So we replaced them with soft touch buttons that *electronically* adjust screen settings at your command. Then we really got creative.

THE ONLY NOTEBOOK WITH A TILT & SWIVEL DISPLAY.

Can you imagine your desktop PC without a tilt and swivel display? Neither

could we. So why not incorporate that feature into a notebook. With the ZEOS Freestyle/SL notebook you can adjust the screen left and right as well as tilt it up and down. Now you can truly adjust your notebook screen to the perfect viewing angle.

IT FLOATS TOO.

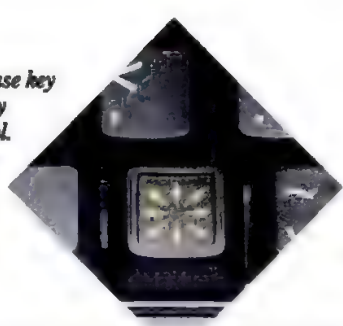
And then there is the "floating" screen. When you're facing your new ZEOS Freestyle/SL, the screen actually appears to "float" in the air in front of you. It's the only notebook that can really be used sitting on your lap!

EXTRA, EXTRA, EXTRAS. READ ALL ABOUT 'EM!

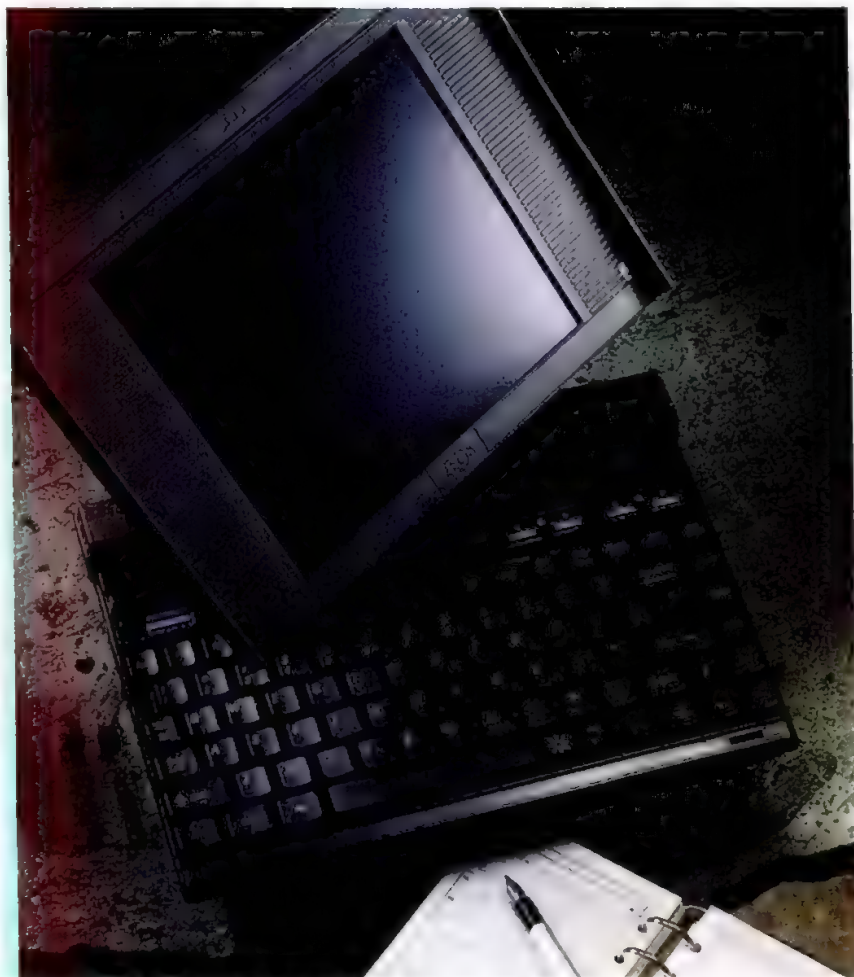
We've made more options available than ever before. Like our modem with send/receive fax. And memory up to 20MB, hard drives to 180MB, even an optional Italian leather carrying case! Extra batteries and a charging stand are available too. Call 800-423-5891 for all the details.

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Please complete all appropriate sections, providing at least two years residence and employment history. **THIS IS NOT A CREDIT AGREEMENT!** One will be sent to you upon authorization of an account. (This form must be signed to process your application.) All financed purchases are subject to credit approval. *If you have any credit questions, please call 800-421-8942 for assistance. Thank you!*

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Home Phone (____) _____ City _____ State _____ Zip _____
Soc. Sec. No. _____ Date of Birth ____/____/____ Employer _____ Since? (Mo./Yr.) _____
Address _____ Apt. _____ Monthly Gross Salary \$ _____ Daytime Bus. Phone (____) _____
City _____ State _____ Zip _____ Previous Employer _____ From _____ To _____
Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____ Occupation _____

A married person may apply for individual credit. I am applying for (please check appropriate box):

☐ **JOINT CREDIT** with another person. Complete entire application.

☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.

☐ **INDIVIDUAL CREDIT**. Do not complete section C.**

** If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS:
YOU MUST DISCLOSE YOUR MARITAL STATUS:

☐ married ☐ unmarried ☐ legally separated

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

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Name & Address of Nearest Relative Not Living With You _____

Relationship _____

B. CREDIT INFORMATION

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Y/N How Many?

Y/N How Many?

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VISA _____ Credit Union Account _____

MasterCard _____ Other Major Charge Cards _____

Finance Company Loan _____

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

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John C. Dvorak

Tactical Windows Warfare

Windows for Workgroups is Microsoft's most misunderstood product. Undoubtedly, the software's not going to make Ray Noorda happy, since it appears to be a threat to Novell's domination of PC networks. The folks at Artisoft with their

LANtastic product aren't too thrilled either. The mail purveyors, such as Lotus with cc:MAIL, will also be annoyed. Microsoft intends to implement a mail system of its own and give the system away free with the networking that comes with Windows for Workgroups. Everyone is mad. Curiously, none of these vendors are the targets of Microsoft's grand scheme. The targets are Apple Computer and John Sculley.

It all began when Apple sued Microsoft for supposedly violating its licensing agreement with Apple for its Windows interface. If Apple had been successful, the suit would have sunk Microsoft, cost billions in retributions to Apple, and derailed Microsoft Windows. Windows for Workgroups is the payback for Apple's insolence. In the process, Windows for Workgroups also solves a slew of marketing problems for Microsoft.

You'll notice how quickly Windows for Workgroups appeared on the scene. For months on end, people were talking about Windows NT, Win32, and Windows 3.1 vs. OS/2. Suddenly, Windows for Workgroups emerges like gangbusters and nobody cares that Windows NT is late. Now the hot talk is Windows for Workgroups. The media began receiving calls from software companies that had sold elaborate modules to Microsoft, which had incorporated them into Windows for Workgroups to make it frighteningly powerful. Windows for Workgroups now looks like it will be the standard Windows of the future.

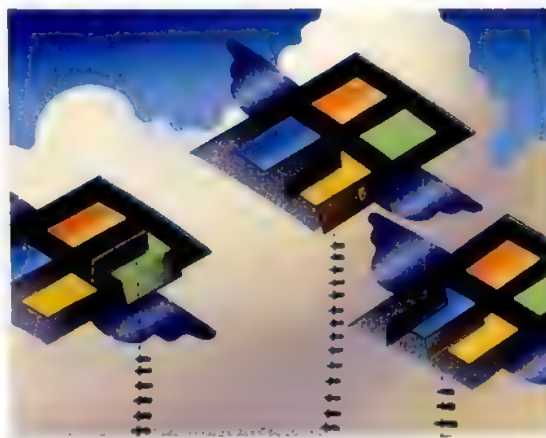
Still, the target is Apple. What Windows for Workgroups does is add the missing link: built-in networking. More than anything else, this makes the PC closer to the Mac. One of the great trick questions you can ask people is, "What is the largest installed network base?" The answer turns out to be

AppleTalk, because it's built into every Mac.

Visitors to NetWorld noticed the commoditization of network adapters, particularly Ethernet cards. Several vendors have developed a cheap, one-chip Ethernet solution that will appear on the motherboards of *all* PC's. Combine the built-in networking of Windows for Workgroups with the low price of PC hardware and you get a package that's irresistible for corporations deciding between a Mac and a PC. No matter that an Apple is far easier to use than a PC; the specifications are now so close that Apple is dead in the business world because true ease of use and installation is never on the spec sheet of the Request for Proposal.

Of course, Apple's strategists have already figured this out and countered with a line of inexpensive consumer-oriented machines called the Mac Performa. But this doesn't do businesspeople much good if it is unlikely their companies would ever buy a Macintosh. I expect Mac sales to businesses to fall off drastically.

Meanwhile, Microsoft also sticks it to its enemy IBM, since OS/2 won't necessarily adjust to the new network-oriented model—although there is no reason the model can't be easily adapted.



Emerging like gangbusters, Windows for Workgroups is the payback for Apple's insolence.

Finally, Microsoft gets to use its LAN Manager code, of which it has been justifiably proud. While Microsoft always had high hopes for LAN Manager, it was outmuscled in the market by Novell. Windows for Workgroups bypasses the marketing process and basically gives away a network for free. Novell and the others will still service the high-performance, large-scale networks for a while, but Microsoft's wish to dominate all aspects of the software business is being fulfilled.

It looks like 1993 will finally be the year of the network.

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The Model 97 combines NEC's microfine toner and Sharp Edge Technology to provide superior print quality. It also includes a built-in envelope feeder and uses a single-piece, eight-thousand-page consumable cartridge.



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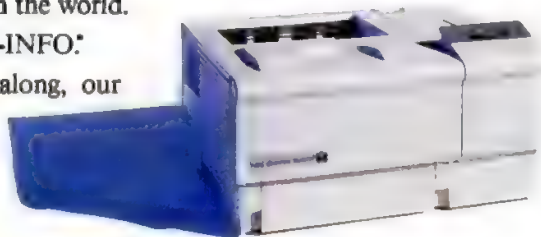
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CIRCLE 217 ON READER SERVICE CARD

Inside Track

Congratulations to Intel for the world-class **bonehead concept** of discarding the 586 moniker and replacing it with a **terrible new name** for the PS/586: the Pentium! Intel has been irked for years about the fact that its microprocessor names have been deemed public domain by the U.S. courts. Anyone can make a 486 or 386 clone chip and call it a 486 or 386. Intel **sued everyone** who used these monikers **to no avail**. Earlier in the product life cycle, Intel had tried to popularize this same chip using the prefix iAPX, as in the iAPX286, for the 80286. No matter: Everyone still called it the 286. I suspect everyone will either call the P5 the 586 or call it the P5. One thing's for sure, **nobody** is going to call it the Pentium. At first, Intel said it would name the chip based on the results of an employee contest. Intel finally hired an outside consultant to come up with the Pentium name. The chairman of competitor AMD called the new name better suited as "a name for toothpaste." Obviously, a user of the pricey French luxury toothpaste, Elgydium (my personal favorite). I think the name sounds like **a new minivan from Toyota**.

Anyway, **Intel will drop the name fast** when tech writers continue to call it the 586 or "Intel's version of the 586." AMD and Cyrix hope to clone the chip as soon as they can, and you can be sure they will call it the 586.

While on the Subject of Reverse Engineering Dept.: Nobody is sure yet how the hardware cloners will be affected by the **stunning court decision** in a recent case. Sega sued Accolade for bypassing its licensing system for Genesis game cartridges. This kind of thing came up before, when Nintendo went after Atari and others who decided that it was **idiotic** to get permission from Nintendo in order to make a game that worked in Nintendo machines. Both Nintendo and Sega want to control the games being used in their machines. There are a number of interesting reasons for this, not the least of which is a **genuine fear** that unchecked game availability will cause price wars and eventually **ruin the business**. Too late now, since the court ruled that Accolade not only could make a Sega game without permission but could **reverse engineer** the Sega software used to let the cartridge talk to the game machine. Furthermore, it could actually use a Sega cartridge as the model for reverse engineering! Who says you can't look at the code of the product you're reverse engineering?

This means that software code of a competitor now

*One thing's for sure.
Nobody is going to call
the P5/586 chip the
Pentium. The chairman
of AMD says it's better
suited as "a name for
toothpaste." I think it
sounds like a new
minivan from Toyota.*

can be examined for the purposes of reverse engineering. No longer do developers have to **shoot in the dark**. The ramifications of this case are far-reaching, and most objective observers applaud the decision. Code is still protected, and the long-standing tradition of **incremental software improvements** based on making a good idea better is back on track. I suspect this concept will carry over to hardware and further complicate Intel's problems with copycats.

Getting an Edge Up on the Competition Dept.: Okay, this isn't a cheap product, but if I were running a hardware or software company, I'd subscribe **immediately**. Dubbed the Information Technologies Strategic Alliances

(ITSA) database, this is **an amazing resource**. Costing \$2,500 a year (updated quarterly), this is a database of every published reference to every strategic alliance in the field of high technology. The publisher, Itsunami Inc. (Box 4756, Berkeley, CA 94704, 510-841-7271), combs newspapers, trade journals, and every publication that makes references to any announcement between companies. There are facts as mundane as to who is providing system software for the daycare center at Lotus. **Hyperlinks** between connections lead to interesting relationships, and you can easily predict future products based on this information. Some of the connections are **frightening**. Highly recommended for anyone involved in strategic planning or corporate research.

Hot Topic 1993 Dept.: I suspect that in 1993 we'll see many hot new technologies and peculiar trends. One hot trend for sure is **removable media mania**. If you haven't been following this trend, you'd better start. There are now three high-capacity removable media alternatives that are delivering huge amounts of data storage in a removable format: the new Bernoulli 150MB disk, the latest SyQuest systems, and the impressive Maxoptix Tahiti read/write optical drive, which writes to an optical platter that holds a gigabyte! All these devices **actually work well** and can be purchased for less than \$1,000 in one form or another. They're mostly being used for graphics storage and for fast backup. **This will be a hot trend** throughout 1993.

It looks like the so-called floptical drive will finally take off this year as the drive appears to have been standardized. Look for the licensed name "Floptical." This technology puts 20MB on a 3.5-inch disk by utilizing an optical servo track. The blank disks sell for a pricey \$20 each, but I see no reason why an entrepreneur can't make and sell them for \$5 apiece. □

Get a better deal on a better 1-2-3

Now that's good news for anyone buying a Windows™ spreadsheet. First, we recently updated 1-2-3® for Windows

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so it now gives you more of the features you've been looking for in a Windows spreadsheet. Second, we

lowered the price to just \$495* (Plus, for upgraders, and for a limited time only, we've included the SmartPics™ Clip-art Sampler absolutely free.)

Of course, when you come right down to it, there are plenty of other reasons why 1-2-3 for Windows is the best spreadsheet choice you can make.

Its features and performance are better than ever.

1-2-3 for Windows now includes more than 25 new features and usability enhancements, as well as a robust set of GUI development tools.

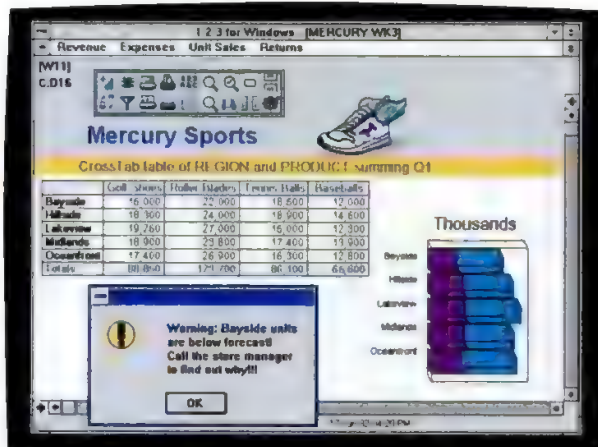
Recent performance enhancements also make 1-2-3 for Windows the fastest-printing Windows spreadsheet for Postscript® output. It also makes the most efficient use of system resources when handling 3D files.

Better still, we're offering license packs for network users so you can set up your network configurations more cost-effectively. All of which makes Lotus® 1-2-3 for Windows the best deal in a Windows spreadsheet.

**It's a better transition
from DOS to Windows.**

Only 1-2-3 for Windows, with its built-in Classic® Menu, lets you use familiar 1-2-3 commands whenever you choose. Excel, on the other hand, only supports 80%

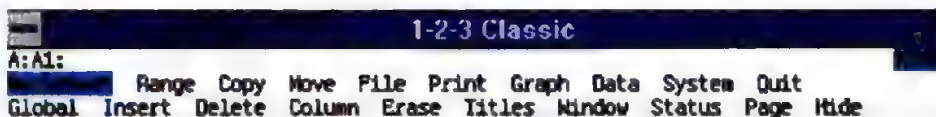
of 1-2-3 Release 2.01 commands. And has no support for releases beyond.



al 3.

What's more, only
1-2-3 for Windows offers

front-end tool of choice." Excel's data
access capabilities rely on a third-



you a better compati-
bility bridge from DOS
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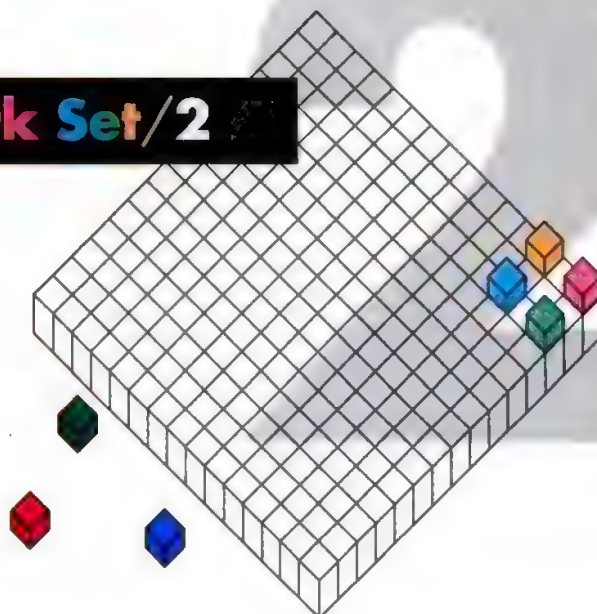
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Jim Seymour

1992's Less-Noticed Software Gems

If 1992 was, as I said last issue, a great year for assorted PC hardware—the printers, scanners, SCSI connections, modems and the rest that, taken as a whole, are at least as important as the PCs we use—it was an even better year for software.

Indeed, the software riches of 1992 were so great that it's almost unfair to try to pull together a short list of the best of the best. But just as with PC hardware, the flash of the big guns of personal computing can lead us to overlook the little gems. Word for Windows 2.0, Excel 4.0, Quattro Pro for Windows, and the other high-flying mainstream packages that emerged in 1992 have gotten their due elsewhere. In this column, I want to call your attention to ten less-well-known programs you may have missed amid the sound and fury of the Big Stuff in software for 1992.

Two stellar examples:

Bought from a British firm that had introduced it in the United Kingdom as Threadz, Organizer went through Lotus-izing in Cambridge and reemerged in the fall as the premier daybook-style app available for Windows-based PCs.

Lotus's earlier personal information manager, Agenda, collapsed under its own weight. Agenda could do anything, with enough time and effort on a user's part. But it turned out that what the great majority of PIM buyers want isn't a rich toolkit, but a rich *application*. In other words, people want a product they can put to work immediately.

Lotus Organizer fits such a thumbnail description perfectly. With clever, even witty use of the graphical user interface paradigm, Organizer makes it easy to keep your calendar, your to-do list, and your name-and-address list at hand. Visual clues abound, from red lines drawn through completed items on the to-do display to a whoosh of flames when you toss an item into Organizer's wastebasket.

If Organizer's print capabilities catch up to its other features quickly enough—and I believe

that will happen sometime in 1993—it may be well-nigh unstoppable.

Organizer is one of those apps good enough to change how we think we view a category of software. So is the Knowledge Adventure series. The first eponymous program in the line, released a year ago, only hinted at what was to come. It was in this year's Sports Adventure and Science Adventure titles—and especially, in the just-released Space Adventure volume—that the series came into its own.

With 256-color VGA, stereo sound, full-motion video clips, and creative simulations, Space Adventure shows just how powerful and entertaining PC educational programs can become. Interestingly, the package does that without a CD-ROM: Space Adventure unpacks its eight floppy disks into 8MB of hard disk space. Real-time decompression as you use the program makes that 8MB go much further than you'd expect.

The only problem with Space Adventure is that—like the other Knowledge Adventure titles—Mom and Dad are likely to find it just as absorbing as do little Kate and Graham. Or is that so bad?

Thumbnail sketches of eight more winners:



Look past the major software releases and you'll find ten little products that made 1992 a winning year.

The first intelligent use of the automation potential of PC fax cards, TeleForm, from Cardiff Software, makes it easy to run surveys, build a remote order-entry system, or create any other application where automated receipt of incoming faxes and transparent conversion of their handwritten alphanumeric data into database files would be a boon.

Inset Systems' HiJaak for Windows program redefined our expectations for PC graphics-file conversion. Click click, and it's done—including the hard ones. HiJaak for Windows is also the best

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PrintDirector Gold Turbo printed nearly five times faster than Novell Lite, almost 2 1/2 times faster than ASP Port Authority, about twice as fast as ESI Share Spool and Buffalo SLmkII, and 40% faster than Lantastic. *Based on printing an output file created with Harvard Graphics. Total time for three PCs to print concurrently to two printers.

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Jim Seymour

screen-capture utility that I have ever seen.

Outside In, from Systems Compatibility Corp., lets us drag almost any kind of file into a Windows document. Font information is lost—Outside In relies, unfortunately, on Windows' lame-brained Clipboard as its transport mechanism—but otherwise the data arrives with formatting intact. And it's so easy.

Ofoto for Windows appeared first for the Mac, in 1991; after teasing those of us who use both platforms, Light Source finally moved this package to the PC/Windows environment in mid-1992. Simply put, Ofoto is the smartest scanning software you've ever seen.

Ofoto can be easily calibrated to produce scans that get the most out of the new longer-gray-scale 600-by-600-dpi laser printers. The package can electronically straighten those all-too-common scans where you laid the copy down on the scanner's platen just a little bit crooked. And—is this a trend?—Ofoto makes all that power easy to use.

Intuit followed up its long string of Quicken successes with its first meant-for-serious-business product, QuickBooks. Quicken makes things easy for those of us who are accounting semiliterates and are never quite sure whether an item ought to be posted as a debit or credit. Now, QuickBooks gives business users the richer, more complex double-entry-style reports bankers and others like to see, while handling the "Is it a credit or debit?" puzzler with Quicken-like ease.

Finally, three long-established programs showed the PC industry's proud tradition of the best getting better.

TimeSlips Pro/Windows and TimeSlips 5 (for DOS) continued TimeSlips Corp.'s domination of the professional time-and-billing marketplace. Both are even easier to use, with even more features and better reports, than their predecessors.

ACT! for Windows was late to market, but the wait was worthwhile for the sales professionals who swear by it. Just as with TimeSlips, Contact Software International's ACT! dominates a large, important and profitable—if not necessarily very visible—part of the PC software marketplace. And ACT! does it on merit, not just market share and momentum.

That's it: ten less-noticed winners that helped make this a banner year for PC software. Now if only the software industry can keep this momentum rolling into 1993. □

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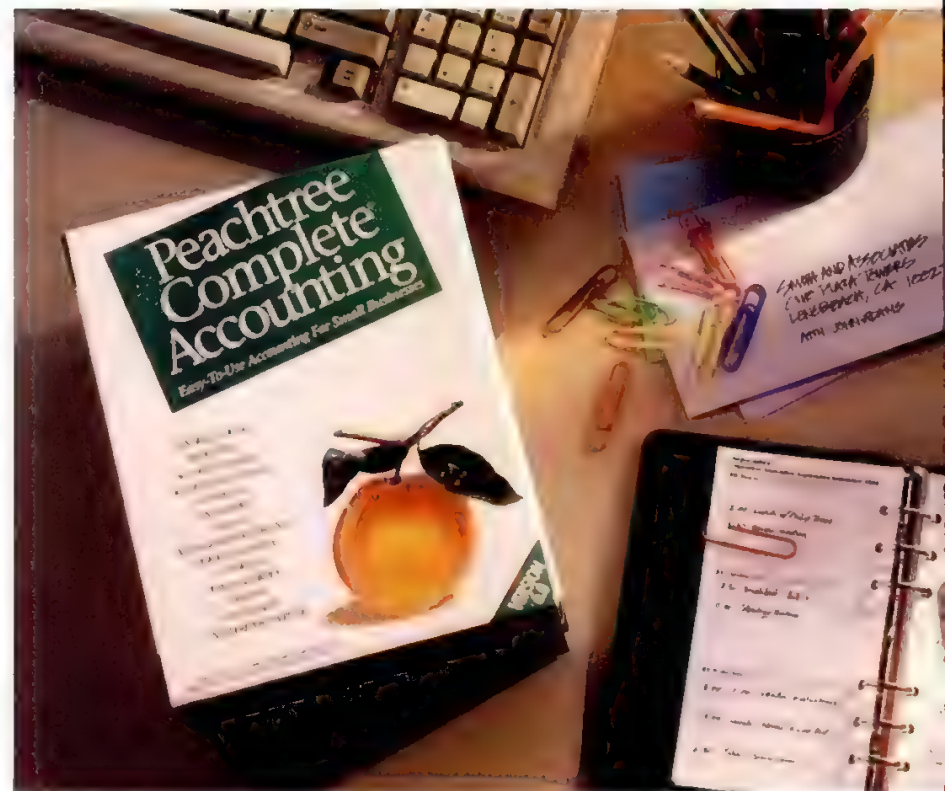
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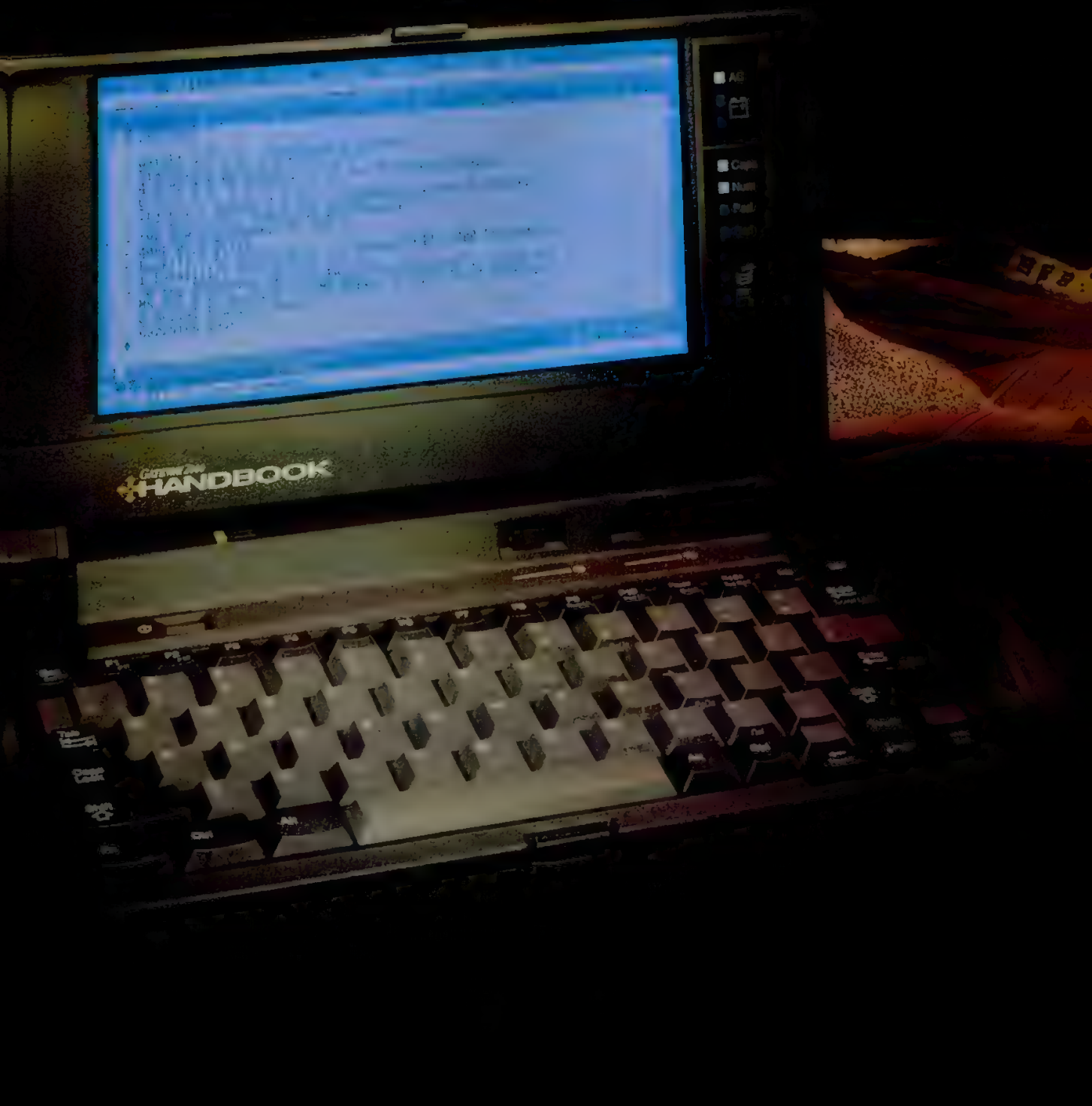


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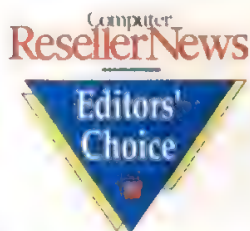
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Bill Howard

The Bottom Line on PC Value

Value line PCs are nothing new. IBM had one in 1983: The PCjr. Value lines are the affordable second or third lines from major players in the retail arena, such as Acer, ALR, AST, Compaq, Hewlett-Packard, IBM, and NEC.

These companies compete with mail-order vendors such as Gateway 2000 and Zeos, and with Packard-Bell and other mass-merchandise PC makers. There are value-line laptops such as the Toshiba Satellite and Compaq Contura. Now even mail-order vendors have value lines: Dell with Dimension, Zeos with Occidental.

In building a value line, vendors walk a thin line. Add too much performance and too many features and they'll cannibalize sales of their higher-end systems. Take out too much and they'll be eaten alive by the mail-order vendors.

The value-line concept blossomed when Compaq rolled out ProLinea last summer. But, PCjr aside, serious value lines predate ProLinea. AST's Bravo value line, for instance, dates to 1988. And value lines aren't exclusive to PCs. The "good" part of Sears Roebuck's good/better/best hierarchy of appliances and power tools is a value line of sorts: fewer features, less performance, lower price.

As a historical example of what can go wrong with de-featured value-line PCs, take the PCjr. Please. IBM straitjacketed the PCjr's internal expandability, crippled the memory subsystem, and built the worst keyboard this side of an automated teller machine. Value-line vendors today are a bit more savvy. You'll get good value. But will you get a great value? There's usually something missing from value lines. If you're shopping for affordable value in a PC, here are some things to watch out for.

What's the biggest failing of value lines? The video, where the difference between fast and slow performance is on the order of 20 to 1. To shave \$250 off the PC's selling price, a vendor may use a frame-buffer design video adapter with just half a

megabyte of memory. That design limits the number of available colors and the refresh rates (how many times the monitor's screen gets redrawn each second). To run Microsoft Windows properly, you want an accelerated video card with a full megabyte of VRAM video memory, and support for a high refresh rate.

Value lines use compact cases that may come up short on drive bays and expansion slots. Until the 3.5-inch floppy disk drive standard completely dominates (give it a year), you should also have a 5.25-inch floppy drive. It's not a bad idea to have a second 5.25-inch bay available in case you add a CD-ROM. With all the integration of I/O, you need fewer slots, but at the least, consider your needs for a modem, network card, CD-ROM adapter, sound card, and, if it has a slow, permanently mounted video controller on the motherboard, a replacement video card.

486-based systems choke without a processor RAM cache, and given the high cost of static RAM for caches, a value-line system may stick with the tiny cache that is being built into Intel 486 CPUs. DX2/50 and DX2/66 CPUs are especially susceptible to flagging performance without an external cache.

Value lines typically use slow 16450 UARTs (serial port controllers) instead of the slightly more costly 16550 UARTs, which would allow a 9,600-bps modem to attain full performance. If the system has a modem, it may be a 2,400-bps model with send-only fax and no error correction. If this sounds like a lot of facts to remember when buying a \$1,299 PC that will likely be far faster and cheaper than what you're using now, you're right. But if you know what features you want in your next PC, you can get great value, not just good value. □



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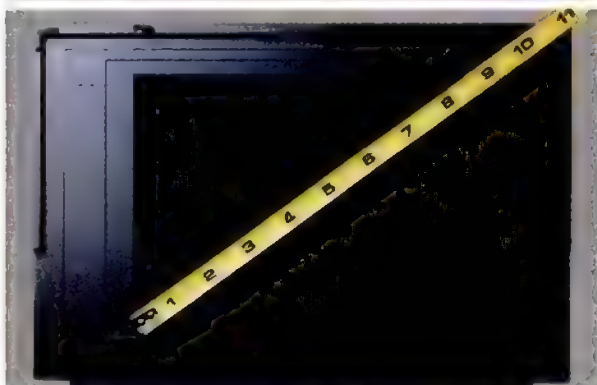
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The Best of 1992



Our editors plow through the morass of new products that appeared last year to celebrate the ones that really stand out.

.....

Are we getting bored yet? Not a chance. As we enter the second decade of computing on the PC, there is no sign that innovation is lagging. There's no doubt that the art of developing products has become more complicated. The emergence of Microsoft Windows and OS/2, the demand for multitasking and networked applications, the intricacies of graphical applications, and the pressure to write products for multiple platforms have all contributed to a lot of products that missed their ship dates in 1992—like the much-debated Microsoft Windows NT, the much-awaited Paradox for Windows, and the much-delayed QuarkXPress for Windows.

Despite the new layer of complications, we've seen no letup in the number of products that pass through the portals of our labs. In fact, the number of products we see has been increasing at a steady rate. Of course, there are a lot more look-alike and act-alike products as vendors vie for your hearts, minds, and wallets. Yet many of the products that did get out the door in 1992 continued to be exciting, intriguing, progressive, and even fun.

These decisions by our editors and frequent contributors are arbitrary but informed; these are the products we really *liked*. Remember, these are nominations made by people whose business is to look carefully at products and figure out if they work the way they are supposed to. This procedure is different from the one we used for last issue's Ninth Annual Awards for Technical



by Joel Dreyfuss



Excellence—our awards for products whose concepts are technically excellent, although their executions may be flawed. In selecting the best products of 1992, we nominated our favorites, argued about them in an electronic town meeting format that existed long before Ross Perot got the idea, and selected the ones that have the most passionate proponents. As you will see from the list of Technical Excellence winners, there is some overlap, in cases where products are both technically innovative and darn good.

The best products are not always completely new. In some cases, the changes are incremental but still important. Lotus Development Corp.'s Ami Pro, Version 3.0; Borland International's Paradox, Version 4.0; and Microsoft Excel For Windows, Version 4.0 have added new features and have raised the standards for their respective categories. With Windows growing hotter as an environment, it was important for traditional vendors to assure their loyal customers they could play by the new GUI rules. The first version of WordPerfect for Windows, Version 5.1, didn't earn an Editors' Choice award from us, but the product helped WordPerfect Corp. to hold onto its customers while its programmers mastered a new, more difficult medium. On the other hand, Borland's first significant foray into Windows—Quattro Pro for Windows—was impressive and included the first signs that object-oriented programming really does bring benefits to the end user.

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won an award for technical excellence in our last issue, the applications for this superior operating system were very slow to appear in 1992. However, Golden CommPass, a specialized communications package for retrieving and managing CompuServe and ZiffNet messages, showed OS/2's potential and won our nod as one of the best products of the year. A user could upload and download messages in the background while reading and answering messages. We expect to be seeing many more nominations in the

Sometimes the path to success is the most obvious. Caught with gaping product line holes in the fast-growing Windows category, Lotus Development Corp. picked up Organizer, a nifty third-party British product that builds on the appointment book metaphor, with hooks to Lotus's Ami Pro, cc:Mail, and Lotus Notes. And while we had seen a number of Windows PIMs (personal information managers), Lotus Organizer impressed us with its simplicity and its straightforwardness. Not surprisingly, Lotus also dumped its slow-selling, DOS-based Agenda, probably the most sophisticated PIM known to humankind—and the most difficult to learn.

While IBM's OS/2, Version 2.0, won an award for technical excellence in our last issue, the applications for this superior operating system were very slow to appear in 1992. However, Golden CommPass, a specialized communications package for retrieving and managing CompuServe and ZiffNet messages, showed OS/2's potential and won our nod as one of the best products of the year. A user could upload and download messages in the background while reading and answering messages. We expect to be seeing many more nominations in the

OS/2 category in the coming year.

And despite the hoopla over GUI, DOS showed it was still screaming lustily. In addition to Borland's Paradox upgrade, Microrim came back from the dead with R:BASE, Version 4.0, a powerful 32-bit database application. LaserTools Corp. brought the benefits of scalable fonts with PrimeType for WordPerfect to the millions who still happily process their words in DOS. And Symantec Corp.'s The Norton Desktop for DOS might have garnered our kudos if not for a few bugs that should get squashed in the next version.

While we can understand the frustration of many readers who complain about our frequent focus on Windows, it's simply that some of the most exciting uses of computers are occurring in this environment.

Desktop faxing, for example, can be tedious in DOS; it simply works better in Windows. Our two favorite fax software products in 1992, Caere Corp.'s FaxMaster and Eclipse Systems' Eclipse FAX, Version 1.1, are both Windows products. FileMaker Pro 2.0 for Windows, a successful transplant of the popular Macintosh database to the Windows environment, may very well be the simplest database to learn and use; the graphical interface has a lot to do with that ease.

In another case of cross-platform transference, Frame Technology Corp. brought its industrial-strength desktop publishing program, FrameMaker 3.0 for Microsoft Windows, from Unix to Windows and challenged companies such as Aldus Corp. and Xerox Corp. to match its document-management strengths in an environment that has often been criticized as too weak for serious enterprise-level work.

The graphical environment makes new uses for the PC possible. It is difficult to imagine a program that allows you to edit fonts, as Fontographer for Windows does, in a DOS-based environment. Or what about MapInfo, Version 2.0 for

Our Contributors: PC Magazine Editors RICK AYRE, CHRISTOPHER BARR, FRANK J. DERFLER, JR., JOEL DREYFUSS, CRAIG ELLISON, MARY KATHLEEN FLYNN, DAVID GREENFIELD, BILL HOWARD, MICHAEL J. MILLER, DON WILLMOTT. Contributing Editors MITT JONES, EDWARD MENDELSON, ALFRED POOR, SAL RICCIARDI, JOSEPH SALEMI, CRAIG STINSON. Frequent Contributors THERESA CAREY, GREGG KEIZER, ROCK W. MILLER, RUBEN RABINOWITZ.

Windows, which translates mind-numbing demographic data into flashy and mind-enhancing charts? Face it, you DOS diehards: That "goosey" stuff is here to stay.

There's still one category in which Microsoft Windows remains less than stellar: fun and games. Our two favorite games of 1992 were highly graphical—but they were DOS-based. Maxis's *A-Train* and Spectrum HoloByte's *Falcon*, Version 3.0, are chock-full of color and graphics, but their programmers shrewdly kept them in the DOS environment, which provides the speed essential to games.

You no longer need to be a game player to extract beeps and bleeps from your PC. Last year was definitely the year that sound erupted in the PC arena. Multimedia Extensions for Microsoft Windows, Version 1.0, helped spread sound to the mainstream. Compaq Computer Corp. added its Compaq Business Audio, and Microsoft Corp. responded with Microsoft Windows Sound System. Now you can not only read your spreadsheet, you can hear it—with running commentaries from your boss or assistant. Yes, we admit it: Sometimes progress has dubious value.

We had no doubt that the creeping phenomenon of networking had shifted to a full gallop in 1992. As more and more computer users interconnected, they also demanded that it all be made less arcane; never mind that network administrators were demanding that these networks link all imaginable types of PCs, Macintoshes, Unix systems, and large computers. SynOptics Communications' LattisNet System 3000 and Novell's NetWare Multi-Protocol Router, Version 2.0, both attempted to make it simpler for network managers—not easier, mind you, just simpler.

Hardware continued to provide the best bargain in computing history in 1992. Competition generated price cuts that lifted the standard of computing power from a 386 to a 486. But the prices of PCs weren't the only ones that dropped.

The modem, an increasingly essential tool for the computer user, benefited from a similar shift in prices. The standard modem speed of 2,400 bps shifted quickly to 9,600 bps and then to 14,400 bps, and vendors threw in fax capability

as chip makers discovered how cheap it was to add a function that might well sell the modem. Intel Corp.'s SatisFAXtion Modem/400 line won our kudos for performing data and fax capabilities extremely well.

In the printer category, Hewlett-Packard continued to overwhelm the competition: No competitor could match Hewlett-Packard's practice of making its next-generation products better—and cheaper. The HP LaserJet 4 followed that tradition. Meanwhile, an important new player entered the printer market: Compaq, which smartly focused on the high end with its new Compaq Pagemark shared network printers. And NEC Technologies found another lucrative niche, providing PostScript capabilities at a low price to the individual user. When it comes to printers, our impression is that there is more than enough business to go

around.

Yes, there were a lot of snazzy products in 1992; we simply didn't have enough room for all the ones we liked, so we listed them in the box. And there were the products that didn't quite make our deadline, or hit the market too late for us to get a good look at them, but seemed as if they might have been strong candidates for a Best of 1992 award. These are included in the box titled "Any Day Now"—named in tribute to soul singer Chuck Jackson, who recorded a song of that name in the 1960s, and our gentle nudge to the many industry vendors who whistle the song under their breath.

1992 was a pretty good year. It had important innovations, improvements to existing products, and a spate of exciting new products. We can hardly wait until next year.

The Best of 1992

Honorable Mention

Our editors also liked the following products.

Autodesk 3D Studio, Release 2 (Autodesk) *These folks brought workstation-class animation to the PC.*

CA-Cricket Paint For Microsoft Windows (Computer Associates International) *A state-of-the art paint program with all the bells and whistles.*

DataEase Express for Windows (DataEase International) *A nifty relational database that still needs some work.*

Flexscan F550i (Nanao USA Corp.) *If you spend a lot of time staring at the screen, treat yourself to this 17-inch monitor.*

Freelance Graphics for Windows (Lotus Development Corp.) *Lotus delivered the easiest-to-use package for presentation graphics.*

HP PaintJet XL300 (Hewlett-Packard Co.) *This printer delivers professional-quality output with Pantone accuracy.*

MAG MX17F (MAG InnoVision) *A sharp screen and good colors helped this 17-inch monitor shoulder aside a lot of better known names.*

Microsoft PowerPoint, Version 3.0 (Microsoft Corp.) *The boys in Redmond who pioneered Windows finally got it right with this version.*

Microsoft Publisher (Microsoft Corp.) *If you absolutely have to do a newsletter and don't have time to learn a package, this is the one to use.*

Microsoft Word for Windows, Version 2.0 (Microsoft Corp.) *A step behind Ami Pro in 1992, it remains one of the most powerful word processors.*

WinJet 800 (LaserMaster Corp.) *An internal card transforms a so-so laser printer into a PostScript speed demon—and that's no oxymoron.*

Alpha Software Corp.

Alpha Four, Version 2.1

BY JOE SALEMI

Alpha Software Corp. has released two upgrades of its flagship product, Alpha Four, since we gave it our Editors Choice award (*PC Magazine*, December 17, 1991). Alpha Four, Version 2.1, (\$549) remains one of the best low-end databases available for DOS and OS/2, with full scripting and macro capabilities, and network support. Because of a common user complaint, the latest release of Alpha Four can now create dynamic sorts when performing a search.

Alpha Four 2.1 uses standard dBASE-type .DBF files for storing data, making it ideal for users who want to access dBASE files without learning how to program in dBASE. You can easily create complex multifile databases for queries or reports through its built-in database-set capabilities. By recording your keystrokes, the scripting and macro language makes it easy to automate common tasks, but it also has enough power to create complete menu-driven applications.

Alpha Four, Version 2.1; Alpha Software Corp., 168 Middlesex Turnpike., Burlington, MA 01803; 800-451-1018 ext. 117, 617-229-2924; fax, 617-272-4876. List price: Single-user version, \$495; multiuser server version, \$549. Competitive upgrade, \$99; 3-user LANPack, \$749; 5-user LANPack, \$1,249; 30-user LANPack, \$4,995. Reviewed: February 25, 1992, page 42.

Circle 492 on reader service card

Lotus Development Corp.

Ami Pro, Version 3.0

BY EDWARD MENDELSON

Ami Pro, Version 3.0, acts like it's in love with Microsoft Windows. Lotus Development Corp.'s \$495 word processor is

the most graphical, colorful, and in many ways the most powerful word processor on the market—and it feels more at home in the GUI world of Windows than in Microsoft Word for Windows.

The latest version adds automated conveniences you can't find elsewhere. It walks you through every step of creating and using a mailing list, complete with a cardfile-style database. You can preview stylesheets and documents before you open them, and a simple click on the right mouse button brings up a menu of all the functions you will probably want most.

As before, Ami Pro 3.0 offers integrated graphing, charting, drawing, and image enhancement, and it lets you edit graphics in the same window as your text. The macro language offers unparalleled flexibility.

Ami Pro has some minor flaws and annoyances that you won't find in other word processors, but no other package can match its ambition, its range of functions, or the sheer pleasure of using it.

Ami Pro, Version 3.0; Lotus Development Corp., Word Processing Division, 1000 Abernathy Rd. NE, #400, Suite 1700, Atlanta, GA 30328; 800-831-9679, 404-391-0011; fax, 404-698-7654. List price: \$495. Reviewed: September 15, 1992, page 39.

Circle 510 on reader service card

Maxis

A-Train

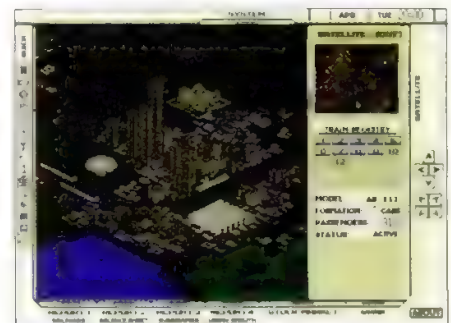
BY JOE SALEMI

Maxis has in the past won kudos from *PC Magazine* for its complex yet entertaining computer simulation games, such as SimCity—The City Simulator, and SimEarth. The company has done it once again with the release of A-Train, an involving simulation that allows train lovers to create and manage railroad and real-estate empires.

A-Train fills the middle ground between SimCity and Microprose's Railroad Tycoon, though it bears more re-

semblance to SimCity. A-Train's emphasis is on growth instead of competition, and you win the game by sustaining population growth through proper management. A game starts with one of six different scenarios, which range from the open countryside to a thriving city. You can develop your railroad in the open fields and encourage people to settle in or expand your suburbs. Or you can take charge of a major city railroad that's on the verge of bankruptcy.

A-Train continues Maxis's reputation for excellent graphics. Impressive touches include shifting light levels to distinguish between day and night, and seasonal changes such as falling leaves in autumn and snowfalls during the winter. Railroad lovers who prefer to spend their time running trains, building up cities, expanding suburbs, and rescuing faltering ventures from bankruptcy instead of



Maxis's A-Train, like the same company's SimCity and SimEarth, has excellent graphics.

fighting competition should definitely give Maxis' A-Train a look.

A-Train; Maxis, Two Theatre Sq., #230, Orinda, CA 94563-3346; 800-336-2947, 510-254-9700; fax, 510-253-3736. List price: \$69.95. Reviewed: September 15, 1992, page 571.

Circle 502 on reader service card

Compaq Computer Corp.

Compaq Business Audio

BY BILL HOWARD

Multimedia adds sizzle to PCs, but it's overkill for most business use. It's overpriced if all you want to do is place a voice annotation on a spreadsheet or add sound effects to a presentation. Enter the Compaq Business Audio, a basically free part on all Deskpro I and Deskpro M Windows Edition PCs. (The Windows

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PPM	9 ppm	9 ppm	9 ppm	16 ppm
Emulation	HP LaserJet II	HPLJII/PostScript	HPLJII/PostScript II	HPLJII/PostScript II
Processor	68000	68000	RISC/8220	RISC/8220
Fonts	14 HP Fonts	17 or 35 Scalable	35 Scalable	35 Scalable
List Price	\$999	\$1,399/\$1,499	\$1,749	\$3,649

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CIRCLE 353 ON READER SERVICE CARD

The Best of 1992

Ninth Annual Awards for Technical Excellence

Here are the winners (marked with a bullet) and finalists for *PC Magazine's* Technical Excellence Awards for 1992 (*PC Magazine*, December 22, 1992). These products are also among the best of 1992.

Hardware Standards

- **PCMCIA, Release 2.0 Personal Computer Memory Card International Association**
- VEBA VL-Bus Standard 1.0 Video Electronics Standards Association**

Operating Systems and Software Standards

- **OS/2, Version 2.0 IBM Corp.**
- TrueType in Microsoft Windows, Version 3.1 Microsoft Corp.**
- Twain Twain Working Group**

Components/Subsystems

- **AMD 3.3-volt CPUs Advanced Micro Devices**
- ATI Graphics Ultra Pro ATI Technologies**
- HP Kittyhawk Personal Storage Module Hewlett-Packard Co.**
- Intel DX2 Intel Corp.**

Networking/Communications

- **Microsoft Windows for Workgroups Microsoft Corp.**
- DigiBoard IMAC DigiBoard**
- Modem M1090 Portable Wireless Modem Ericsson GE Mobile Communications**

After Hours

- **Knowledge Adventure Interactive Books Knowledge Adventure**
- IntelliCharge in Quickset, Version 6.0 Intuit**
- Midisoft Studio for Windows Midisoft Corp.**

Peripherals

- **NEC Intersect CDR-74 NEC Technologies**
- Kodak Photo CD system Eastman Kodak Co.**
- Philips CDD 521 Philips Consumer Electronics Co.**

Printers

- **Kyocera Ecosys a-Si Printer FS-1500A Kyocera Electronics**
- Compaq Pagamarq Series Compaq Computer Corp.**
- Tektronix Phaser IID Tektronix**

Applications

- **Quattro Pro for Windows Borland International**
- Approach 1.0 for Windows Approach Software Corp.**
- Microsoft Excel for Windows, Version 4.0 Microsoft Corp.**

Development Tools

- **Borland C++ 3.1 Borland International**
- Microsoft Visual Basic Programming System for MS-DOS Microsoft Corp.**

Graphics Applications

- **Fractal Design Painter for Windows, Version 1.2 Fractal Design Corp.**
- Aldus IntelliDraw, Version 1.0 Aldus Corp.**
- Ofoto for Windows Light Source**

Portables

- **Toshiba T4400SX Toshiba America Information Systems**
- Dell 320SLI Dell Computer Corp.**
- Z-Note 325Lc Model 120 Zenith Data Systems**

Systems

- **Compaq Deskpro 98/11 Compaq Computer Corp.**
- Compaq Systempro/XL Compaq Computer Corp.**
- Gateway 4DX2-66V Gateway 2000**

Person of the Year

- **Michael S. Dell, Dell Computer Corp.**

Lifetime Achievement

- **Raymond J. Noorda, Novell Inc.**

Edition version gives you a \$375 video accelerator, a mouse, DOS 5.0, Microsoft Windows 3.1, and Business Audio.)

Business Audio consists of an Analog Devices AD1848 SoundPort, a microphone, a higher-quality system speaker, and software to record and play voice and other sounds under Windows 3.1. You also get utilities to play audio CDs if you

have a CD-ROM, and a file manager for your Business Audio sound clips.

The package shares its sound chip and Microsoft-written software with the \$289 Microsoft Windows Sound System, providing equivalent functionality. Business Audio surpasses first-generation 8-bit sound cards, and if it's not on par with \$500 sound cards, that's fine with the au-

dience Compaq wants to reach.

Compaq Business Audio (Included with *Compaq Deskpro I* and *Deskpro M Windows Edition* systems); upgrade for *Deskpro M* line, \$187. *Compaq Computer Corp.*, P.O. Box 692000, Houston, TX 77269-2000; 800-345-1518, 713-370-0670. Not previously reviewed in *PC Magazine*. Circle 515 on reader service card

Do You Make These Six Common Mistakes On Your Taxes?

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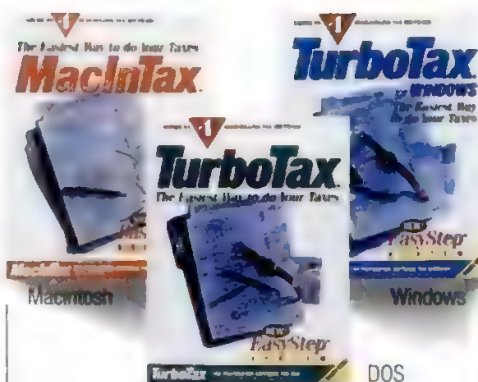
3 The Omitted Form
Even "ordinary" returns require anywhere from six to a dozen forms to complete. It's easy to miss one ... or end up rushing all over town to find the one you need.

4 The Misinterpreted Instruction
At best, IRS instructions can be tough to understand. At worst they can be mind-boggling. What you need are clear directions in plain English.

5 The Overlooked Deduction
You'd have to be a professional tax preparer to know all the deductions you're entitled to. If you miss just one, it could cost you hundreds of dollars.

6 The Exceeded Guideline
The fastest way to trigger an IRS audit is to exceed the "normal" range on one of your deductions. You need to know what the IRS looks for on a line-by-line basis.

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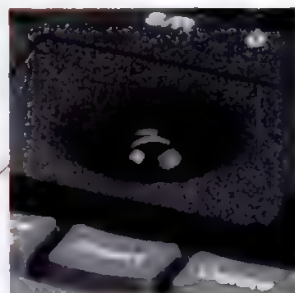
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CIRCLE 126 ON READER SERVICE CARD

Compaq Computer Corp.

Compaq Pagemark 15 Compaq Pagemark 20

BY JOEL DREYFUSS

Compaq took its sweet time getting into the printer business, but when it finally did, it created quite a splash. Hewlett-Packard should sit up and take notice. The Compaq Pagemark 15 and Compaq Pagemark 20 are shrewdly aimed at corporate customers, who need fast, networked printers.

These new laser printers are speedy (rated at 15 pages per minute and 20 ppm, respectively) and turn out quality prints in Adobe PostScript Level 2 emulation as well as Compaq's own Print Enhancement Technology. PostScript, along with parallel and serial ports, come standard with both printers, and both can sense if incoming documents use HP PCL 5 or PostScript.

The optional \$569 Ethernet connector lets you set the printers up as either remote printers or print servers on a NetWare-based LAN. There is also a fax option for transmitting to fax machines or other PostScript fax printers.

These new printers from the rejuvenated Compaq open a new front in this company's battle to regain respect.

Compaq Pagemark 15, Compaq Pagemark 20; Compaq Computer Corp., 20555 SH 249, Houston, TX 77070-2698; 800-345-1518. List price: Pagemark 15, \$3,999; Pagemark 20, \$5,499. Reviewed: November 24, 1992, page 233. Circle 517 on reader service card

Corel Corp.

CorelSCSI

BY MARY KATHLEEN FLYNN

The beauty of the small computer system interface (SCSI)—its ability to support up to seven devices with one adapter—has long been marred by more than just

the ugly sound of its "scuzzy" moniker. SCSI's inability to provide compatibility with an adapter from one vendor and a peripheral from another has offended on a much more practical level. But last year, the interface received a much-needed facelift from a source you may not have expected: Corel Corp., which delivered a set of drivers it pledged will work with any SCSI device on the market.

Its best-selling graphics package, CorelDRAW, may have put Corel on the map, but the Ottawa-based company also makes the drivers that are sold with 75 percent of all WORM devices. The company's bold commitment to support all SCSI devices (backed up by its testing and certifying them) should make Corel-SCSI just as popular.

The software is available by itself for \$99 or it comes bundled with adapters from Adaptec, Always Technology Corp., BusLogic, and Distributed Processing Technology, and others, with prices starting at \$250.

CorelSCSI; Corel Corp., 1600 Carling Ave., Ottawa, Ontario, Canada

K1Z8R7; 800-836-7274, 613-728-8200. List price: \$99 (software only). Reviewed: June 16, 1992, page 48.

Circle 518 on reader service card

Hewlett-Packard Co.

Dashboard for Windows

BY RICK AYRE

Hewlett-Packard Co.'s Dashboard for Windows is lean, mean, and trim—rather unusual features for a Microsoft Windows program. It sets up as a well-organized collection of icons that control your desktop. Dashboard does three things very well: It manages virtual screens, provides an easy-to-customize quick launch, and makes printer management painless.

Though other programs offer similar features, none of them provides quite the elegance of Dashboard. This remarkable program takes up less than 950K of disk space, installs in a snap, and is so easy



Dashboard for Windows lets you juggle programs in up to seven virtual windows.

to use you can throw away the manual.

Virtual screens, or what HP calls extended screens, are an effective way to juggle several open programs. Dashboard allows for three, five, or seven virtual screens, and the software displays them all in thumbnail form.

You can choose which programs to make available as quick launch buttons, how many virtual screens to manage, and which of the optional buttons will appear.

Dashboard can work as a PROGRAM replacement shell, or it can run like other Windows programs. Using Dashboard, you won't make any wrong turns.

Dashboard for Windows; Hewlett-Packard Co., Direct Marketing Organization, P.O. Box 58059, Santa Clara, CA 95051; 800-752-0900, 208-323-2551; fax, 208-344-4809. List price: \$69. Reviewed: November 10, 1992, page 53.

Circle 484 on reader service card

Caere Corp.

FaxMaster

Eclipse Systems Inc.

Eclipse FAX, Version 1.1

BY ALFRED POOR

People have discovered that sending and receiving fax transmissions with their computers can be easy and efficient. Fax software is better than ever, thanks in large part to the broad acceptance of Microsoft Windows. Two programs stood out in 1992: FaxMaster and Eclipse FAX, Version 1.1.

FaxMaster, from Caere Corp., solves an important problem: what to do with a fax once it's on your computer's disk. Most packages let you view and print the contents of an incoming fax, but FaxMas-

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No NOS required, but can be used with most popular NOS's

moving up to peer-to-peer or client/server networking by just adding software.

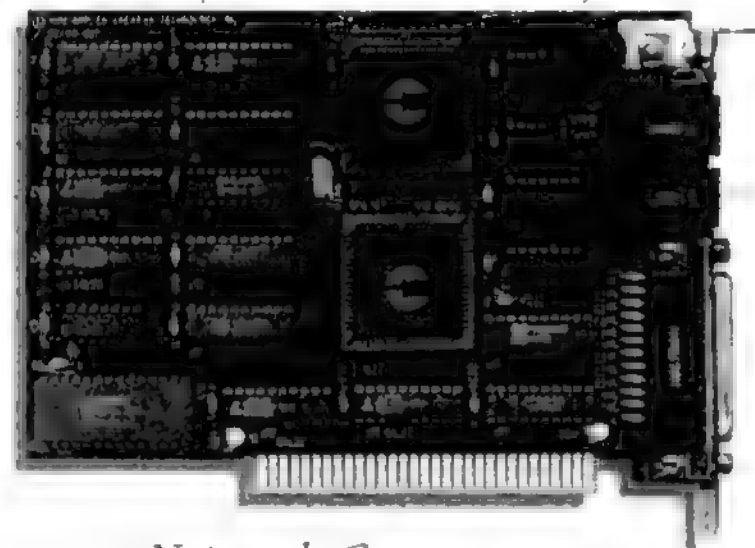
Other NET Solution additions include network tape backup, CD ROM sharing, modem sharing, and FAX sharing. The NET Solution is all its name implies.

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ter goes a step further: It can automatically apply optical character recognition to the fax image and convert it into computer-readable text. The program includes a spell-checker and a simple editor that lets you view the converted text and make changes.

The program has other attractive features: It can display the first pages of fax documents as thumbnail sketches, and it automatically adds an option for sending or viewing faxes to the File menu of most Windows applications.

Eclipse FAX, from Eclipse Systems, tackles a different problem. Instead of converting faxes to text, it concentrates on making faxes easier to find. Its sophisticated archiving and retrieval features include 52-character indexed identifiers for each fax document, and long memo fields give you room to make more detailed notes about a fax's contents.

As good as these two programs may be, however, their lead may be short-lived. Many competing packages are planned to have upgrades that will add OCR and better fax-management features. With this kind of competition, the user is bound to come out ahead.

FaxMaster; Caere Corp., 100 Cooper Ct., Los Gatos, CA 95030; 800-643-3915, 408-395-7000. List price: \$149; competitive upgrade, \$79. Reviewed: December 8, 1992, page 316.

Circle 512 on reader service card

Eclipse FAX, Version 1.1; Eclipse Systems Inc., 33 W. Monroe St., #1121, Chicago, IL 60603; 800-452-0120, 312-541-0260; fax, 312-541-0514. List price: \$119. Reviewed: December 8, 1992, page 288.

Circle 513 on reader service card

Spectrum Holobyte Inc.

Falcon, Version 3.0

BY ALFRED POOR

Falcon, Version 3.0, from Spectrum Holobyte is one of the premier flying combat games on the market, putting you in the cockpit of a fully-equipped F-16 jet fighter. Unlike games that are little more than arcade shoot-em-ups, Falcon's hallmark is realism through painstaking attention to the tiniest details. Different enemy radar installations are based on real technology, and you must use different strategies to minimize detection depend-

The Best of 1992

Any Day Now

.....

These were the products that sounded as if we might like them a lot. But they were still largely vaporware when we went to press. As Yogi Berra might say: It ain't a product 'til it's a product.

DOC.IT (Okidata Corp.) *Okidata's combination printer, fax, and scanner could be an unwieldy octopus—or a boon to the small business.*

486SL (Intel Corp.) *We can forgive Intel for flooding the market with variations, but their decision to cut back the flavors of this power-saving chip caught vendors by surprise. Still, we all crave better battery-life.*

KeepInTouch Card (AT&T Paradyne Corp.) *AT&T's tour de force in squeezing a full 14,400-bps data and fax modem onto one of these cards could mean truly lighter laptops without sacrificing a floppy disk or backlighting.*

Microsoft Windows NT (Microsoft Corp.) *Microsoft's plan to rule the world hinges on selling this full 32-bit OS to people who have sniffed at PC products in the past.*

NetWare 4.0 (Novell Corp.) *It ain't easy being No.1. With Microsoft nipping at their heels, Ray Noorda's troops decided that getting it right was more important than getting it out. Well, to a point, that's true.*

Paradox for Windows (Borland International) *Borland's long-awaited object-everything database promises to set a new standard—if it ever gets out of Scotts Valley.*

QuarkXPress for Windows (Quark) *Having conquered the Macintosh market for desktop publishing, Quark's Windows version could shake up the established order on the Intel platform.*

WinFax PRO, Version 3.0 (Delrina Technology) *Delrina's continued domination of desktop fax depends on this successor to its hot Windows fax software.*

ing on which type of radar you face.

This is not just a point-and-shoot game, either. It models the physics and physiology of flight; mishandle your craft and you run the risk of stalling, or "redding out" from too many positive or negative Gs.

Falcon 3.0 has incredible graphics, including realistic cloud effects and shaded horizons, though the frame rate slows down in high-detail mode when the fur starts to fly. There are digitized music and radio transmissions—the first adds entertainment value, while the second adds realism.

With three different theaters of conflict (Kuwait, Israel, and Panama), Falcon is difficult to master, so you are not likely to grow tired of it anytime soon. If you are looking for a high-tech challenge flying a complex combat craft, Fal-

con will give you a workout.

Falcon, Version 3.0; Spectrum Holobyte Inc., 2490 Mariner Square Loop, Alameda, CA 94501; 800-695-4263; 510-522-1164; fax, 510-522-3587. List price: \$79.95. Not previously reviewed in PC Magazine. Circle 514 on reader service card

Claris Corp.

FileMaker Pro 2.0 for Windows

BY JOE SALEMI

Although the market has become crowded with low-end Microsoft Windows databases, FileMaker Pro 2.0 for Windows still stands out. This version of Claris Corp.'s popular Macintosh product gives Windows 3.x users an easy way to create fairly complex databases.

"ALPHA FOUR IS THE DATABASE MANAGER I CAN RECOMMEND TO ALL MY CLIENTS. IT'S THE ONLY POWERFUL DATABASE THAT'S SPECIFICALLY DESIGNED FOR NON-PROGRAMMERS!"

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PC Week gave Alpha Four a #1 Rating and PC Magazine (Feb. 25, 1992) states, "Alpha Four Version 2 delivers on the promise to be even more powerful without giving up any of the features that earned it our Editor's Choice."

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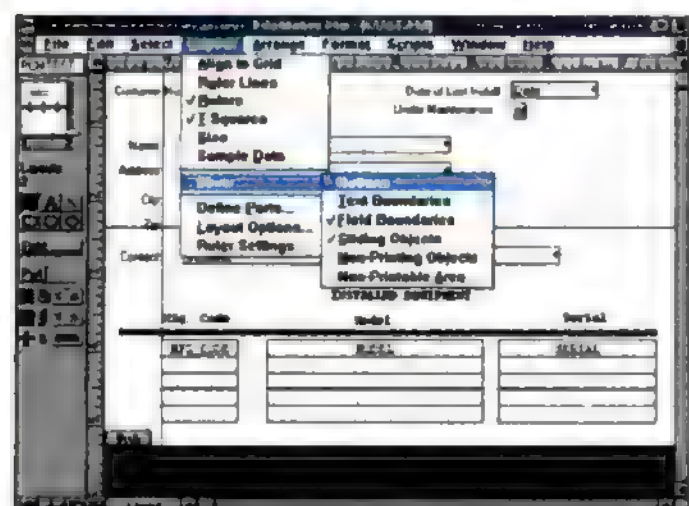
InfoWorld, May 11, 1989; DHMS, December, 1991; PC World, March, 1990;
PC Computing, June, 1992, August, 1992

All trademarks registered to the appropriate companies.

Q&A

FileMaker Pro is essentially a flat-file database. Screen displays and reports are based on custom-designed layouts, which are created through its object-oriented interface. It uses the Windows GUI to the fullest, with on-screen rulers and T-squares, and you can even include graphical images in a database. It really shines when you run it under Windows 3.1, where you can include sounds as part of the database—ideal for creating your own multimedia applications.

FileMaker Pro stores its data as indexed text, which makes for very fast queries and searches. It even includes a



FileMaker Pro 2.0 for Windows bases reports on custom-designed on-screen layouts.

spell-checker that you can use for your data entries.

FileMaker Pro combines a powerful database engine with an intuitive interface; it is by far the best low-end Windows database available today.

FileMaker Pro 2.0 for Windows; Claris Corp., 5201 Patrick Henry Dr., P.O. Box 58168, Santa Clara, CA 95052-8168; 408-727-8227, 408-987-7000. List price: \$399. Reviewed: December 22, 1992, page 37.

Circle 519 on reader service card

Altsys Corp.

Fontographer for Windows

BY EDWARD MENDELSON

Altsys Corp.'s \$495 Fontographer for Windows brings professional typographic design software to the PC for the first time. Programs that inaugurate a new product category often look awkward, but Fontographer, after years of refinement in its Mac version, is a successful combination of power and elegance.

Under Microsoft Windows, Fonto-

grapher allows you to create or modify scalable typefaces in both the PostScript-language Level 1 format and Windows' native TrueType format. It adds the "hinting" instructions that improve output at low resolution, and, if you know what you're doing, lets you edit individual hints for Level 1 faces only.

Type designers can create a new typeface using the program's drawing tools, which include a pressure-sensitive pen that varies the width of a line depending on how hard you press on a drawing tablet. Corporate users can take an existing typeface and insert their logo in place of a little-used character. This is a rare example of software that's intuitive enough for beginners and versatile and powerful enough for professionals.

Fontographer for Windows; Altsys Corp., 269 W. Renner Pkwy., Richardson, TX 75080; 800-477-2131, 214-680-2060; fax 214-680-0537. List price: \$495. Reviewed: December 8, 1992, page 37.

Circle 482 on reader service card

JP Software Inc.

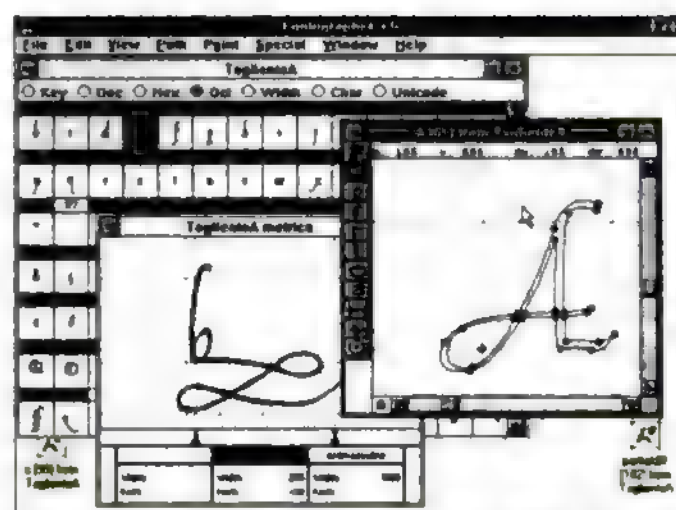
4DOS, Version 4.01

BY CRAIG ELLISON

If you don't want to follow the pack into the GUI world of Windows, JP Software's 4DOS, Version 4.01, is an alternative. This replacement for COMMAND.COM adds welcome features and new functionality to your DOS command line.

4DOS makes working from the DOS prompt a pleasure. This is a well-designed program that features an automatic installation procedure and a powerful, mouseable hypertext help system. 4DOS adds the commands DOS never had. For example, the MOVE command allows you to move a file from one location to another, which means that you do not have to copy the file and then go back and delete the original.

SELECT, perhaps one of the most powerful 4DOS commands, lets you



Fontographer lets you edit character shapes in convenient and intuitively designed windows.

group and tag files for further action. The ALIAS command lets you define one- or two-letter substitutes for your most frequently used commands. Other features include an environment editor, a command line editor, command line history in a pop-up

window, colorized directory listings, and a built-in utility for scrolling up and down through documents.

4DOS is shareware and well worth the download from CompuServe, GENie, or other BBS's, and the \$69 registration fee.

4DOS, Version 4.01; JP Software Inc., P.O. Box 1470, E. Arlington, MA 02174; 800-368-8777, 617-646-3975; fax, 617-646-0904. List price: \$69. Reviewed: October 13, 1992, page 293.

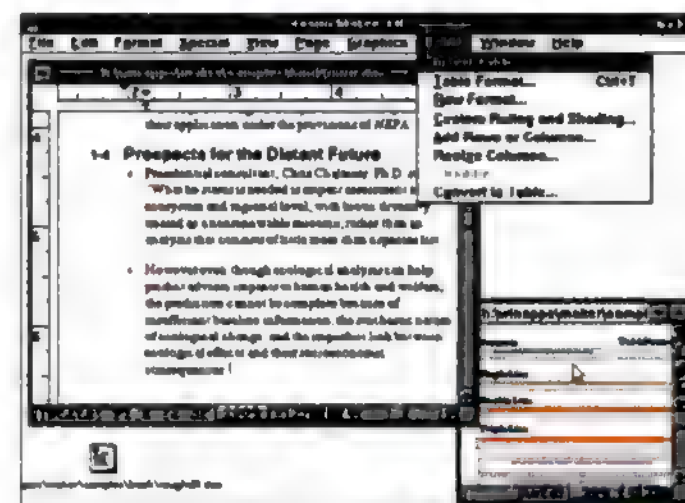
Circle 481 on reader service card

Frame Technology Corp.

FrameMaker 3.0 for Microsoft Windows

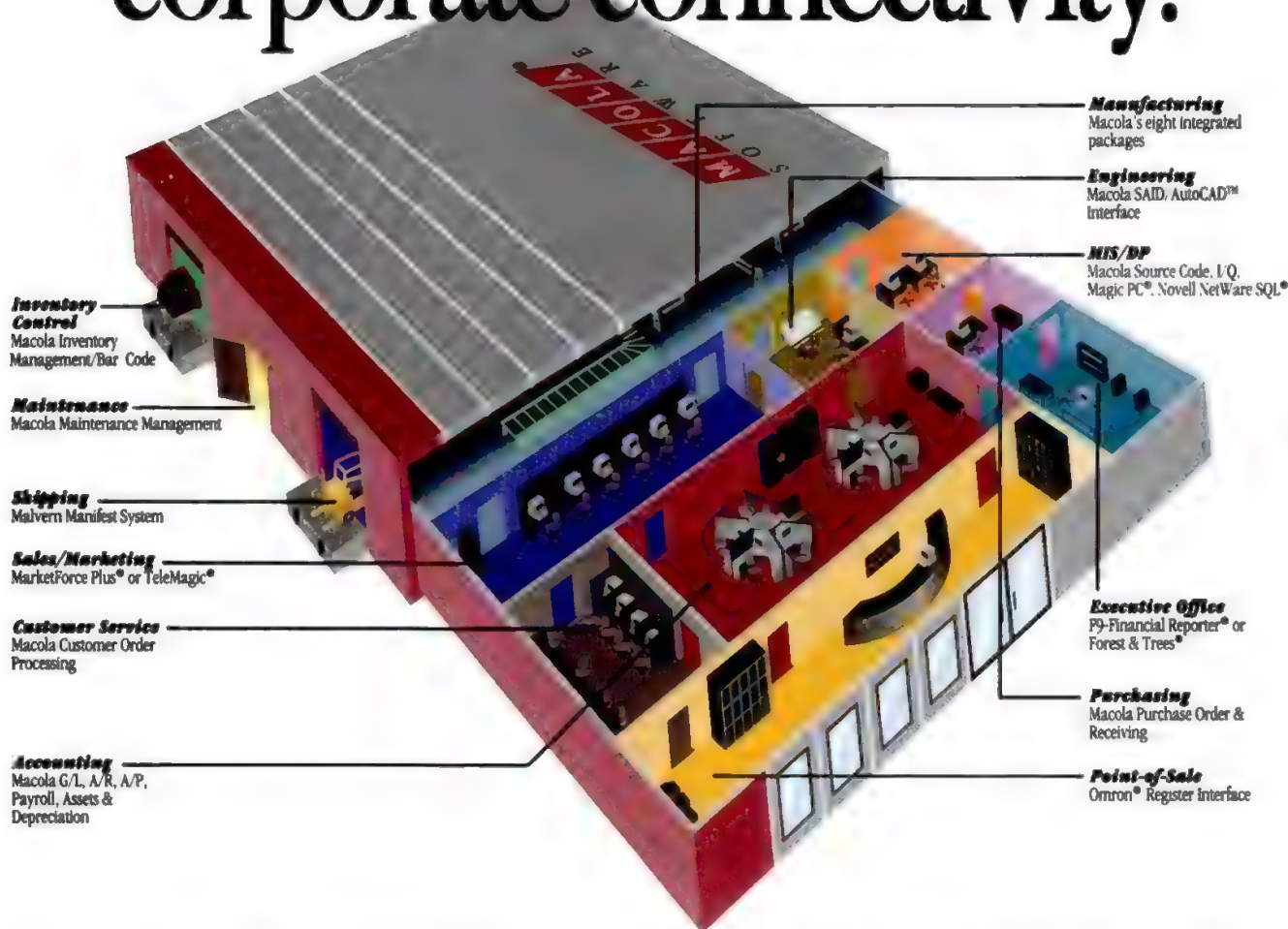
BY EDWARD MENDELSON

Until FrameMaker 3.0 for Microsoft Windows arrived this year, Aldus PageMaker and Ventura Publisher forced PC-based desktop publishers to live with inconveniences and limits that no one would tolerate. Frame Technology Corp.'s \$795 FrameMaker 3.0 package is the first DTP program that lets you open multiple files at the same time, use free-hand drawing tools, and create hypertext documents. Its equation editor doesn't merely format equations; it solves them.



FrameMaker lets you store custom-designed elements and import them anywhere in a document.

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1992 Thumbs Up/Thumbs Down

If ever there was an industry in search of a mood ring, it was the PC business in 1992. If you asked 10 people whether times were good or bad, you got 23 answers.

Hardware vendors couldn't decide whether to laugh or cry, as prices plummeted. Their volumes soared, but with profits razor-thin and quarterly losses looming, many PC vendors danced on the edge of solvency. Meanwhile, PC software publishers were deliriously happy with their roaring sales—except when they stopped to condemn Microsoft for what they called its monopolistic practices. Microsoft bashing became a national sport; everyone from the business magazines to the FTC jumped in. But was this the same Microsoft that created Windows, the hardware demands of which were

the primary force persuading millions of PC users that it was time to trade up—and also driving that boom in software?

It was hard to tell whether business was booming or bottoming out. Maybe both, some said.

But never fear: Boom or bust, we can count on the pocket protector set for unwitting self-parody, for moments of joy and sadness, stupidity and genius, soaring achievement and soaring egos. This is, after all, the PC industry.

Here are our Thumbs Up and Thumbs Down Awards for 1992. And a few Thumbs Sideways Awards too, for things both smart and stupid, in the spirit of the brilliant Siskel and Ebert routine on "Sesame Street."

—Jim Seymour

 **Thumbs Up** to **Compaq** for a heroic reinvention of the company, after years of drifting while the best of the market raced forward. Compaq's **ProLinea** desktop machines, Contura portables, and ProSignia servers forced the rest of the PC industry to wake up, cut prices sharply, and look for ways to improve their service and support—to match the Compaq cowboys. Yah-HOO! Ride 'em, Eckhard.

 **Thumbs Down** to **Compaq** for sitting for months on its deals with direct marketers to sell **ProLineas**. Unfortunately, some of the soon-to-be-authorized direct marketers got just a bit antsy. By October USAFlex was advertising Compaqs for sale, before Compaq's new channels were even announced—and while Compaq was still struggling to get machines into the hands of its long-suffering dealers, who'd been waiting for stock since June. Compaq then irritated its dealers even more by shipping big volumes of its hottest machines to its also-new superstore outlets—while the shelves of those same long-time dealers were still bare.

 **Thumbs Down** to the **Dark Avenger** and his ilk for their introduction of such wonderful, productivity-enhancing apps as the virus mutation engine and similar developers' kits.

 **Thumbs Up** for persistence in the face of proprietary mania to the **Video Electronics Standards Association (VESA)** for its work in establishing the new VL Bus for local-bus video.

 **Thumbs Sideways** to **Novell/Digital** for not releasing **DR DOS 7** yet, without which Microsoft has no template to use in designing DOS 6.

 **Thumbs Up** to **IBM** for shipping a better **OS/2 2.0** than any of us expected.

 **Thumbs Down** to **IBM** for shipping **OS/2 2.0** without the video drivers needed to put it to work, for fouling up distribution so that the package took forever to get into the market, for not providing 720K floppy disks until long after first shipments, and for uneven and sometimes self-defeating treatment of potential OS/2 developers. **John Akers** says that all of this is going to change. Really. Soon. Uh-huh. We're still waiting, Blue Ninjas.

 **Thumbs Down** to **Intergraph** for showing us that the **HCR—Hubris Contamination Risk**—is greater than we ever knew. Self-centered hubris has long been a major part of the PC software world. And now Intergraph, czar of big-iron CAD software, is moving into the PC realm with a new package

called **Microstation PC**. When Jeff Prosize tested it at PC Magazine Labs on a stock Compaq 486, the package bombed every 30 minutes with a message that made it appear to be a demo program with a built-in timeout. Intergraph's response: That's a bug in the interface between the software and the parallel-port dongle the company uses for copy protection. The company's suggestion (we're serious): Replace the Compaq's serial ports and hard disk controller. But Mr. Intergraph, Prosize persisted, isn't that asking an awful lot of a PC owner just to get to use your program? Oh no, sez Intergraph: People have to do it all the time to run our software.

 **Thumbs Up:** A triple thumbster to **Corel** for its heroic work in creating SCSI drivers that really work, across the board; for being smart enough to team up with Adaptec for SCSI hardware; and for packaging a CD-ROM full of artwork and fonts in every box of CorelDRAW.

 **Thumbs Down** to the entire personal computer industry for failing to come together on a standard **CD-ROM format**. This collective failure means that consumers can't buy one disk that will work interchangeably on desktop business machines (PCs, Macs, MPCs, IBM's Ultimedias), TV machines (Tandy's VIS), and Personal

Digital Assistants (Sony's MMCD Players).

 **Thumbs Down:** Farewell, Mystic Ones: **WEB Technologies** eagerly demonstrated for us a spectacular file-compression algorithm that was supposed to deliver a 16:1 reduction in file-size per round—and you could keep packing the file tighter and tighter through successive rounds. But WEB would not discuss just how this magic was achieved, only assuring us that the compression was completely lossless. WEB Technologies wasn't, though: The company went under soon after the demo.

 **Thumbs Up** to all those vendors who do both DOS and Windows versions of their products, so you can have the graphical version on the desktop and a workable DOS version on your laptop—both using the same file format.

 **Thumbs Up** for one of the smartest moves of the year: **Microsoft's purchase of FoxPro**. The Fox team followed leader Dave Fulton from the cozy confines of the Midwest to Microsoft's lair outside of Seattle. Now if Mr. Bill will just let them get on with their work (it was, remember, Fox that had the vision of where the Xbase world should go, not Microsoft), all those folks who have carped about Microsoft products' redefining the meaning of *slow* may finally have to shut up. Maybe.

 **Thumbs Down** to **Microsoft** for its endless insistence that **Windows NT** would ship by the end of '92. Those who waited for real developers' kits (beyond the initial, incomplete CD-ROM "beta" SDK released in May) knew that it wasn't possible. And even Microsoft execs were saying privately "no way." Just because Microsoft is becoming as big as IBM (or maybe IBM is becoming as small as Microsoft) doesn't mean it should adopt Big Blue's bad habits.

 **Thumbs Up** to Zenith Data Systems, NEC, and a very few other companies displaying a newfound attention to good design. In 1992, ZDS's Z-Note portables and floor-standing servers, and NEC's gorgeous FG series of monitors—all from California's **frogdesign inc. studios**, by the way—helped civilize offices through their attractive and intelligent design.

 **Thumbs Down** to the makers of **front-projection LCD touch screens**, who ignore the fact that when you try to touch the screen to execute commands, you block the projector, so you can't see what you're pointing at!

 **Thumbs Down** to Lotus No. 2 for not updating its long-in-the-tooth mail product, cc:Mail. It sure feels tired, guys. Mr. Manzi, could we maybe interest your techno-wizard, Mr. Landry, in bringing cc:Mail into the nineties? Before they're over? (Which brings up an interesting question: Since not everyone at Lotus has Notes, what do staffers use for e-mail? cc:Mail? And they don't notice?)

 **Thumbs Up** to DEC for its robust reentry into the direct-market PC business. The old machines were okay; the prices weren't. Now **DEC** has hot PCs and hotter prices, and the PC Market Leaders club has a tough new competitor pounding on the door.

 **Thumbs Down** to **Borland** for dragging out the release of Quattro Pro for Windows and Paradox for Windows far beyond their initial release dates. Borland was set for one of the strongest new-product release cycles in the history of the PC business in 1992, but instead watched momentum dissipate as both products fell behind.

 **Thumbs Up** to Microsoft for **Windows for Workgroups**, which may well prove to be the most significant software product of the year. It didn't hurt that the product appeared several

months earlier than it had been promised. Maybe the rest of Microsoft could take a hint. . . ?

 **Thumbs Sideways** to ALR for its aggressive pricing—and repricing. Especially on August 10: **ALR** issued press releases with new prices, then learned that Compaq had cut its prices, too, and so hurried out a second round of press releases with even lower prices.

 **Thumbs Up** with an oak leaf cluster of envy to **Michael Dell**, who on June 18 watched in horror as the value of his company's shares fell by 25 percent, after a meeting with securities analysts in which he said his company would accept a slightly lower margin on its sales. So he promptly bought 200,000 more Dell shares on the open market to show his confidence in the company's future. Just three months after this bold move, those shares had almost doubled. It's nice to see someone bet on his own company. And nicer still when he pockets a cool quarter of a million for his trouble.

 **Thumbs Sideways** to the Federal Trade Commission for snooping around Microsoft. Maybe Microsoft should be broken up, but (we know this is a selfish argument) Microsoft apps sure do benefit from their developers' proximity to the systems-side developers. Maybe PC users' best hope: **The Feds** scare the willies out of Microsoft but don't actually break it up.

 **Thumbs Up** to AMD for its persistence in challenging Intel on the CPU front. **AMD's chips**, especially the 3.3-volt low-power series, help to keep Intel honest and on its toes—as well as making for great bargains for PC buyers.

 **Thumbs Up** to **Symantec** and **Borland**, and a very few other developers, who still do whizzy DOS apps like The Norton Desktop and Quattro Pro 4. □

FrameMaker is able to organize huge documents created across a multiplatform network, and a document can be based on up to 25 template pages. Though not convenient enough for you to throw away your word processor, or graphically powerful enough to make you discard your illustration program, it's the only DTP package that can tempt you to do so.

FrameMaker's footnoting is awkward, its table editor doesn't include spreadsheet functions, and you work with only eight colors. But unless you need the advanced typographic controls in Ventura Publisher or the convenient pasteboard metaphor used in PageMaker, you'll find FrameMaker more powerful and flexible than any other DTP program.

FrameMaker 3.0 for Microsoft Windows; *Frame Technology Corp., 1010 Rincon Cir., San Jose, CA 95131; 800-843-7263, 408-433-3311; fax, 408-433-1928. List price: \$795; competitive upgrade, \$395. Reviewed: August 1992, page 61. Circle 483 on reader service card*

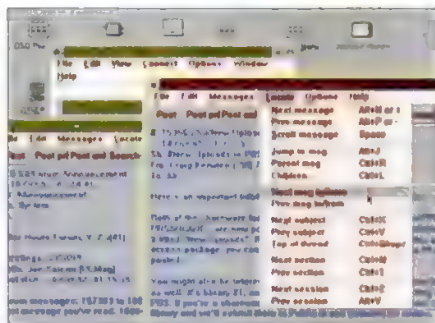
Creative Systems Programming Corp.

Golden CommPass, Version 2.0E

BY JOE SALEMI

Specialized communications programs such as AutoSIG and TAPCIS let DOS users easily get around the archaic interfaces used by CompuServe and ZiffNet. While users of OS/2 2.0 could run one of these programs in a DOS session, there's a better choice: Golden CommPass, Version 2.0E, a \$99 Presentation Manager program that brings OS/2's multitasking power to automated on-line access.

Golden CommPass runs on OS/2 1.21 or later, is file-compatible with TAPCIS, and makes full use of OS/2's multitasking and multithreading capabilities. You can start reading and replying to your new messages while still downloading others on a separate forum, or you can tag the name of a new utility file and have



Golden CommPass brings OS/2's multithreading capabilities to CompuServe and ZiffNet.

CommPass is the best way for OS/2 users to access ZiffNet and CompuServe easily.

Golden CommPass, Version 2.0E; *Creative Systems Programming Corp., P.O. Box 961, Mt. Laurel, NJ 08054-0961; 609-234-1500; fax, 609-234-1920. List price: \$99; introductory CompuServe membership kit (includes more than one hour of connect time), \$15. Not previously reviewed in PC Magazine. Circle 511 on reader service card*

Hewlett-Packard Co.

HP LaserJet 4 HP LaserJet 4M

BY EDWARD MENDELSON

Compared with the HP LaserJet III—the most popular laser printer ever made—Hewlett-Packard Co.'s \$2,199 HP LaserJet 4 produces sharper output, works faster, takes up less desktop space, holds more paper, comes with more memory, and costs \$200 less.

The printer uses a new Canon engine that prints at 600-dpi at 8 pages per minute. HP's Resolution Enhancement Technology raises the resolution to around 1,000 dpi—near the limits of toner-based technology. The rated speed matches that of the LaserJet III, but a 20-MHz RISC processor gives you fast graphics. Two input trays let you print letterheads or second sheets.

You get 35 built-in scalable Intelli-

Golden CommPass download it in the background while you read messages off-line.

A 32-bit version is due out in 1993, and future versions will extend Golden CommPass's off-line message capabilities to other on-line services. For now,

fonts and 10 Microsoft TrueType fonts, and you can print TrueType fonts downloaded directly from Windows. If that's not enough, \$2,999 gives you the HP LaserJet 4M, with Adobe PostScript Level 2, 6MB of RAM, and an AppleTalk port.

You can pay more for faster or more expandable printers, but you can't find a combination of speed, economy, and high-resolution output that approaches that of the LaserJet 4.

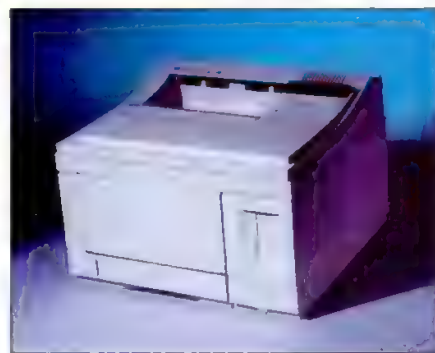
HP LaserJet 4, HP LaserJet 4M; *Hewlett-Packard Co., Direct Marketing Organization, P.O. Box 58059, Santa Clara, CA 95051; 800-752-0900, 208-323-2551; fax, 800-333-1917. List price: HP LaserJet 4, \$2,199; HP LaserJet 4M, \$2,999. Reviewed: November 24, 1992, page 170. Circle 485 on reader service card*

Intel Corp.

Intel 486DX2/66

BY BILL HOWARD

What a difference a year makes. Intel's highest-performance PC microprocessor, the Intel 486DX2/66, evolved from a strategy for upgradable CPUs that originally drew hoots of derision. Remember the processor upgrade socket and its horrible acronym, PUS? The idea was that you would buy a limited-power CPU today, such as a 486SX (with the math coprocessor present but disabled), then plug a more powerful CPU into the upgrade socket tomorrow. Tomorrow is here, and with Intel's speed-doubler technology, you can buy



The \$2,999 HP LaserJet 4M comes with 6MB of RAM, Adobe PostScript Level 2, and an AppleTalk port.

a CPU that runs at full speed inside the chip (66 MHz in the case of the DX2/66) and at half that speed outside. This lets you use a less complex, less expensive system design. PCs based on the Intel 486DX2/50 work at 85 to 90 percent of the performance level of a 486DX/50; the 486DX2/66 usually outperforms the DX/50. You can buy the DX2/66 as an upgrade, called OverDrive, for most existing 486 systems, or get it already installed in a new PC. Better still,

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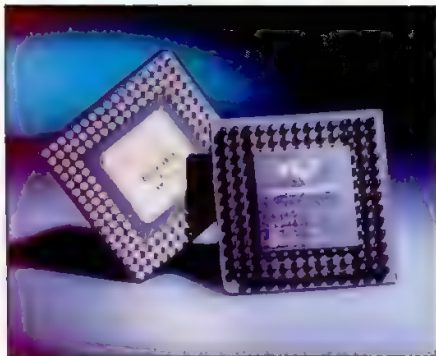


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Prices and configurations are subject to change without notice. Prices do not include shipping.



Intel's high-performance 486DX2/66 is available as an upgrade (called OverDrive) or with a new PC.

systems designed to accept the DX2/66 may be able to accept some form of Intel's next-generation technology, originally named P5 but now called Pentium.

Intel 486DX2/66; Intel Corp., 2200 Mission College Blvd., Santa Clara, CA 95052; 800-346-3028. List price: 1,000 units, \$600 each. Not previously reviewed in PC Magazine.

Circle 486 on reader service card

Synoptics Communications Inc.

LattisNet System 3000

BY FRANK J. DERFLER, JR.

Your network is no better than its cabling system. Corporate network managers crave flexibility, reliability, and help with their management tasks. They get those features in big helpings from a LattisNet System 3000.

This is a high-end device designed for networks with an assortment of cable types, including FDDI (Fiber Distributed Data Interface). With prices that range from just over \$4,000 for the basic cabinet and power supply to over \$25,000 for a system with SNMP (Simple Network Management Protocol) and connections for FDDI, Ethernet, and Token-Ring, the System 3000 is the ultimate network problem solver.

The System 3000 features a unique backplane construction that allows simultaneous monitoring and control of three

100-megabit-per-second data paths within the hub. If you need high reliability for your networking, you can have redundant power supplies, dual processors in the management module, and redundant paths for data. A special SNMP proxy agent allows management of the hub from any TCP/IP station. At the high end of wiring systems, the System 3000 is the hub to beat.

LattisNet System 3000; SynOptics Communications Inc., 4401 Great America Pkwy., Santa Clara, CA 95054; 408-988-2400; fax, 408-988-5525. Reviewed: November 10, 1992, page 343.

Circle 487 on reader service card

Lotus Development Corp.

Lotus Organizer

BY GREGG KEIZER

Lotus Organizer, one of the PC's best-looking, easiest-to-use, and least expensive personal information managers (PIMs), owes more than just a nod to the popular Day Runner and Day-Timer.

On the most basic level, Organizer looks and works like a paper-based pocket organizer, right down to its section tabs and page-style interface. But unlike Day-Timer, where information is static and unconnected, Organizer allows you to link appointments with names and phone numbers, or link to-do items with files on your PC. These dynamic connections

are easily the most impressive part of Organizer, even though they take the most time to maintain because they're far from automatic.

Organizer offers a calendar, a to-do list, an address book, a long-range planner, and an anniversary

reminder. It alerts cc:Mail and Lotus Notes users to incoming messages.

Organizer can't compete with full-blown contact managers—it will not show you more than one of its modules at a time, and the database for addresses is barely customizable—but it is an outstanding single-user PIM. If only you

could stuff it into your pocket!

Lotus Organizer; Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 800-343-5414, 617-577-8500. List price: \$149; \$69 upgrade for Agenda 2.0 users. Not previously reviewed in PC Magazine.

Circle 488 on reader service card

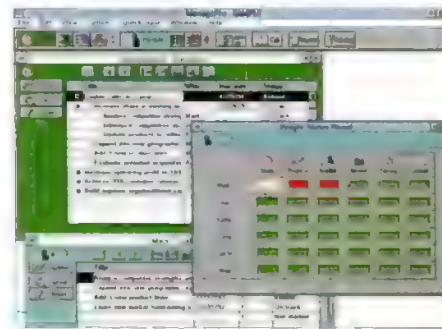
Avantos Performance Systems Inc.

ManagePro for Windows, Version 1.0

BY MICHAEL J. MILLER

Avantos Performance Systems' ManagePro for Windows, Version 1.0, deals with the challenge of managing goals and people in a new way. Taking its cues from both personal information managers (PIMs) and project management systems, ManagePro provides a structured approach to goal planning and people management.

The program offers several ways to



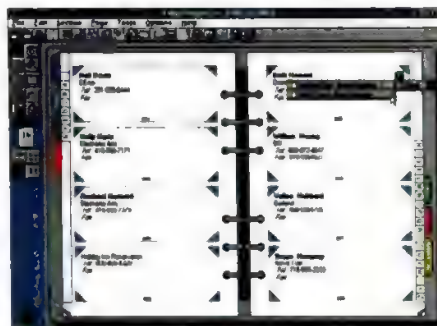
Colored squares on ManagePro for Windows 1.0's status board show people's progress toward goals.

view and enter data. You can enter multiple goals for your organization or work-group in a structured outline format, assign each goal to a person, give it a due date, and enter the goal's status.

You can create individual goal planning sheets for each person, with the ability to set due dates and priorities. A status board gives you green, yellow, and red squares showing how each person is doing on goals.

ManagePro is better than anything else we've seen at goal tracking, and it does it in an intriguing, visually interesting manner.

ManagePro for Windows, Version 1.0; Avantos Performance Systems Inc., 5900 Hollis St., Suite C, Emeryville, CA 94608; 800-282-6867, 510-654-4600; fax, 510-654-



You can link contacts in Lotus Organizer's address book for instant connections between personnel.

1276. List price: \$395; network access module, \$99 per station. Reviewed: September 29, 1992, page 44.
Circle 490 on reader service card

MapInfo Corp.

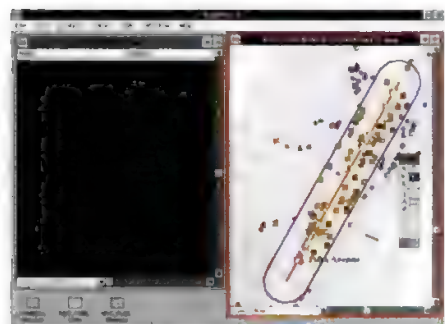
MapInfo, Version 2.0 for Windows

BY ROCK MILLER

Geographic information systems—a technology that was once fit only for those who were obsessed with planning—have arrived for the business user with the entry of MapInfo, Version 2.0 for Windows.

Think of this \$995 Microsoft Windows program as the Harvard Graphics for demographics: a tool for visualizing and analyzing reams of data in graphical form. With MapInfo for Windows, you can turn any information with a locational component—an address or even a ZIP code—into shaded regions or a series of symbols on a map. Superb data handling, multiple layers, good color and font support, and flexible DTP-like page layouts give you the power you need to create rich, interactive graphics to tell (or discover) a complex story.

What raises MapInfo for Windows above the rest of the pack is its careful attention to the user interface. The clean multiwindowed relational database allows you to manipulate records from multiple files using dialog boxes and SQL (structured query language) commands, as well as by drawing or selecting regions on the map. It imports and exports data and maps in a variety of formats, and well-designed functions make the arcana of geocoding and map projection fairly straightforward. Finally, as a Windows-based product, this package supports all



MapInfo, Version 2.0 for Windows, can turn any data with a locational component into a region on a map.

the advanced hardware on the market.

MapInfo, Version 2.0 for Windows; MapInfo Corp., 200 Broadway, Troy, NY 12180; 800-327-8627, 518-274-6000; fax, 518-274-0510. List price: \$995. Reviewed: October 27, 1992, page 37.

Circle 491 on reader service card

Microsoft Corp.

Microsoft Excel for Windows, Version 4.0

BY CRAIG STINSON

Microsoft Corp. made its venerable Windows spreadsheet even more powerful and easier to use in 1992. Microsoft Excel for Windows, Version 4.0, supplies a

wealth of powerful new financial, statistical, engineering, and calendar worksheet functions, along with a richer set of analytic commands. The new commands let you generate moving averages, apply exponential smoothing, create nonuniformly distributed

series of random numbers, and perform rank-and-percentile analysis. With the new worksheet functions, you can calculate bond yields, figure the number of workdays between two dates, and even manipulate imaginary numbers.

Excel's ease-of-use innovations were even more striking. Version 4.0 introduced drag-and-drop cell manipulation, an AutoFill feature that lets you create sequences of labels or values by dragging pattern cells, and the ability to apply designer formats to worksheet ranges with a single stroke.

With Excel 4.0, Microsoft broadened the range of tasks that a spreadsheet can address and at the same time put those tasks within reach of a larger population of users.

Microsoft Excel for Windows, Version 4.0; Microsoft Corp., One Microsoft Way, Redmond, WA, 98052; 800-426-9400, 206-882-8080; fax, 206-936-7329. List price: \$495. Reviewed: November 10, 1992, page 151.

Circle 509 on reader service card

Microsoft Corp.

Microsoft Mail for PC Networks, Version 3.0

BY RICK AYRE

Microsoft Mail for PC Networks, Version 3.0, is what organizations need in an e-mail package. It has all the features to please both administrators and end users.

The easy-to-use graphical interface is available for Microsoft Windows, OS/2, and the Macintosh. There is even a character-mode DOS version, so DOS users won't feel left behind. But it's in the graphical mode that Microsoft Mail excels, and the Microsoft Corp. program-

mers prove once again that they know how to write a slick interface.

E-mail administrators will also appreciate an interface that's easy to use, one that features pull-down menus and context-sensitive help. We believe that most straightforward,

day-to-day e-mail administration chores can be handled by someone who is not terribly technical. In Microsoft Mail we find a product with the potential to become the cornerstone of any organization's workgroup strategy.

Microsoft Mail for PC Networks, Version 3.0; Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-227-4679, 206-882-8080; fax, 206-936-7329. List price: Server with 10-workstation MLP, \$695; 20-workstation upgrade, \$1,395; 100-workstation upgrade, \$5,500; Not previously reviewed in PC Magazine. Circle 493 on reader service card

Microsoft Corp.

Microsoft Windows Sound System

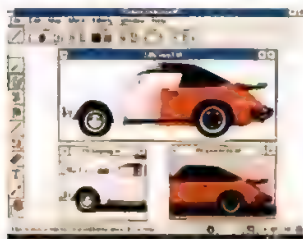
BY CHRISTOPHER BARR

I do not play games, but since I run lots of Microsoft Windows applications, I thought it was about time I added sound to my system anyway. The \$289 Microsoft

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Thinking Mac? Think again. Sending out for retouching? Save your money. Because with Picture Publisher® and a PC, you have everything you need to do your own



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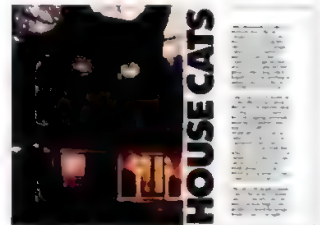
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PC Magazine 4-14-92

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September 1992
Picture Publisher 1.1

Picture Publisher beat all Mac and PC-based competitors in a recent InfoWorld review (8-10-92).

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Introducing Wind

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Now several people can share printers, so everyone can use the printer that best suits their needs, just by clicking a button.

MICROSOFT WINDOWS FOR WORKGROUPS

Since we've included Microsoft Mail, you can instantly send electronic mail to individuals or everyone in your workgroup. You can even add sounds and pictures.

We've also included Microsoft Schedule+, so you can manage calendars and schedule meetings with others. And you can spend more of your workday actually working.

Windows for Workgroups. Great business relationships on a level of give and take.

As anyone in business would tell you, success often depends on how well you can work with others.

Not coincidentally, this is the strength of the Microsoft® Windows™ for Workgroups 3.1 operating system.

In fact, with its built-in networking, one could describe Windows for Workgroups as downright gregarious.



The file manager toolbar lets you use your network as fast as you can point and click. It gives you access to commonly used functions, such as sharing files and sending documents, at the touch of a button. How could sharing information be any easier?

For starters, you can say goodbye to the old "mind if I borrow your disk" routine. With Windows for Workgroups, you'll be able to share files and applications, even printers, faster than you can say "eject."

And then there's this handy little feature called Schedule+.

Say you want a meeting on Tuesday with Matt, who has a meeting with Duncan and Karen, who, wouldn't you know it, are meeting with Jim that same day.

No problem.

Just a couple of clicks and, zip, everyone's schedules are laid out right in front of you. So you can book a meeting without making a jillion phone calls.

Even things as basic as sending memos are simplified with Microsoft Windows for Workgroups. Now you can send electronic mail, including voice and graphics, to anyone in your workgroup.

In other words, Windows for Workgroups lets you share something with your coworkers other than frustration.

But just because it has these advanced capabilities doesn't mean that you'll need an advanced degree to understand it.

Quite the contrary.

Microsoft Windows for Workgroups is based on the familiar interface that millions

of people have come to love. Even if you've never used Windows, it's the ideal starter network.

And since it works with Windows-based and MS-DOS® applications just like Windows 3.1, you can preserve and build on any investment you make in Microsoft Windows.

Which brings up our final point.

Windows for Workgroups is great for creating workgroups on existing networks, like LAN Manager and NetWare®, as well.

All in all, it'll give you a whole new level of efficiency and productivity.

To find out more, go to your local computer retailer. Or call us at (800) 426-9400,

Department HM7, for the store nearest you.

Once you discover everything Microsoft Windows for Workgroups can do, you'll want to share it with everyone.



Microsoft
Making it easier

Windows Sound System lets users add playful sounds to Windows events. You can listen to audio CDs on a CD-ROM drive, annotate files with audio messages, and proof Microsoft Excel and Lotus 1-2-3 for Windows spreadsheets by hearing the cell contents read aloud.

Sound System comes with a microphone and headphones, and it has a headphone/speaker port, two RCA-style line-out jacks, a line-in port, and a microphone port, but no MIDI port. It records and plays Microsoft Wave (.WAV) files, and plays MIDI sound files.

Best of all, Microsoft Windows Sound System has a nifty voice-recognition utility, called Voice Pilot, that accepts voice commands.

Microsoft Windows Sound System; Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-828-8080; fax, 206-936-7329. List price: \$289; with Microsoft Windows 3.1, \$349. Reviewed: November 24, 1992, page 37. Circle 494 on reader service card

NEC Technologies Inc.

NEC Silentwriter Model 95

BY MITT JONES

Very often you get what you pay for. Sometimes you get more. Buying an NEC Silentwriter Model 95 falls under this latter category.

Based on a 6-page-per-minute Minolta engine, the \$1,749 Silentwriter Model 95 comes standard with both HP PCL 5 and Adobe PostScript Level II, including the standard 35 scalable Adobe fonts. Other base-priced equipment includes 2MB of RAM, a 250-sheet letter-size cassette, and a manual feed tray that doubles as a 15-envelope automatic feeder. The 300-dot-per-inch Silentwriter Model 95 supports automatic interface switching via its parallel, serial, and AppleTalk interfaces, and automatic emulation switching is accomplished with



With a street price as low as \$1,400, the Silentwriter Model 95 is one of today's best hardware bargains.

proprietary SIMMs (\$199 for a 2MB module and \$399 for a 4MB unit).

With a street price as low as \$1,400, the NEC Silentwriter Model 95 constitutes one of today's best hardware bargains. If you need Level II and PCL 5 in a solid and affordable package, you should look here first.

NEC Silentwriter Model 95; NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; 800-325-5500, 508-264-8000; fax, 508-264-8673. List price: \$1,749; 2MB RAM upgrade, \$199; 4MB RAM upgrade, \$399; Reviewed: November 24, 1992, page 196. Circle 495 on reader service card

Novell Inc.

NetWare MultiProtocol Router, Version 2.0

BY DAVID GREENFIELD

Who says that connecting your networks has to be expensive? At \$995, Novell's NetWare MultiProtocol Router, Version 2.0, gives you excellent performance without breaking your budget. MultiProtocol Router allows you to connect your LANs together without limiting network management capabilities. You want all your NetWare and LAN Manager workgroups connected to your main office? Novell's NetWare MultiProtocol Router will let you do just that.

Yet while most routers require expensive proprietary

the aid of a 5K TSR.

This latest laser offering from NEC accommodates a respectable collection of options, including a \$599 PostScript fax modem. Two slots will accept HP-compatible font cartridges, and the printer can accommodate up to 5MB of RAM with the addition of pro-

platforms, MultiProtocol Router loads on a PC or onto a NetWare 3.11 file server, further reducing the product's cost.

The NetWare MultiProtocol Router directs many different types of traffic, including that which runs over AppleTalk, IP, IPX, Novell's NetBIOS, and OSI. These networks can be built using virtually any LAN interface. The LAN interfaces that are currently supported are ARCnet, Ethernet, FDDI, LocalTalk, and Token-Ring. For wide-area connections, the Point-to-Point Protocol and X.25 are supported.

NetWare MultiProtocol Router, Version 2.0; Novell Inc., Internetworking Products Division, 2180 Fortune Dr., San Jose, CA 95131; 408-434-2300; fax, 408-946-9761. List price: \$995. Not previously reviewed in PC Magazine. Circle 489 on reader service card

Symantec Corp.

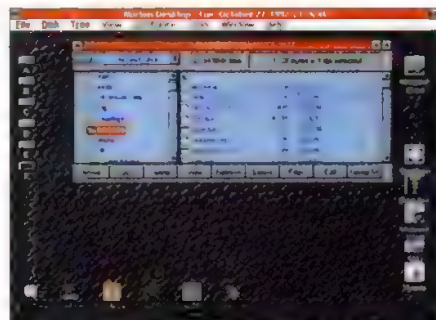
The Norton Desktop for Windows, Version 2.0

BY JOEL DREYFUSS

When The Norton Desktop for Windows debuted in 1991, we immediately recognized the innovation in its desktop drive icons, drag-and-drop features, and powerful Microsoft Windows batch language. But the first version was as slow as drying paint. Symantec Corp. came up with a faster version in 1992 that turned this package into a truly useful tool.

One look at The Norton Desktop and even the most ardent PC fanatic can't help but whisper "Macintosh." The drive icons line up nicely on the left. You can drag a file from the file manager and drop it on a printer icon to print. On recognizing the file as coming from a Windows

application, The Norton Desktop starts the application, telling it to print the file. You can drag and drop files onto an icon for the program's more than 45 file viewers. You can place icons for your favorite Windows and DOS programs



Symantec's revved-up version of The Norton Desktop for Windows is a truly useful tool.

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The Shoebox. Pick up any receipt from your pile of records. Use the scroll-down list that TaxCut shows you to identify the type of record. Key in the figure. TaxCut decides where it should go on your return, then does all the calculations.

Direct to Forms. Simply enter the numbers, and let TaxCut automatically carry the amounts to each relevant form. TaxCut then does all the math.

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The Best of 1992

on the desktop for easy access.

The powerful batch language can be used to run programs, create customized menus, and perform housekeeping. It includes Windows versions of other Norton utilities, including a backup program, viewers, and antivirus software.

The Norton Desktop for Windows, Version 2.0; Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; 800-441-7234, 408-253-9600; fax, 408-255-3344. List price: \$179. Reviewed: September 29, 1992, page 149.

Circle 496 on reader service card

Oxford University Press,
Electronic Publishing

The Oxford English Dictionary, Second Edition, on Compact Disc

BY RUBIN RABINOVITZ

The second edition of The Oxford English Dictionary is one of the most comprehensive reference works ever published. The printed version, a 20-volume set that costs \$2,750 and weighs 137 pounds, contains 616,500 definitions of words and terms in 290,000 main entries, 249,000 etymological listings, 137,000 pronunciation guides, and 2.4 million quotations.

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The Oxford English Dictionary, Second Edition, on

Compact Disc; Oxford University Press, Electronic Publishing, 200 Madison Ave., New York, NY 10016; 800-334-4249 ext. 7127, 212-679-7300 ext. 7127; fax, 212-725-2972. List price: \$895. Reviewed: December 22, 1992, page 348.

Circle 497 on reader service card

Borland International Inc.

Paradox, Version 4.0

BY SAL RICCIARDI

Borland International's Paradox, Version 4.0, was a long time in coming. For Paradox loyalists and die-hard users, the wait was worth it. The new release ushered in a major overhaul to a product that was too dependent in look and feel on the old way of doing things. Luckily, the improvements in Version 4.0 are implemented in a way that lets users who are familiar with earlier versions get up and running quickly.

The most useful feature is the most obvious—the new user interface. Borland based the new Paradox on its TurboVision model, including support for a mouse, for multiple overlapping windows, for resizable windows, and for pull-down menus. Underneath this is an event-driven model that provides the basis for many of the improvements to PAL, the Paradox Application Language.

The new release also adds speed, support for binary large objects and memo fields, and improved support for secondary indexes, among other things. If you use Version 3.5 or an earlier version, you'll want the upgrade.



Paradox 4.0 features pull-down menus, overlapping windows, and full mouse support.

Paradox, Version 4.0; Borland International Inc., P.O. Box 660001, 1800 Green Hills

Rd., Scotts Valley, CA 95066-0001; 800-331-0877, 408-438-8400. List price: \$795; Reviewed: November 10, 1992, page 39. Circle 498 on reader service card

LaserTools Corp.

PrimeType for WordPerfect

BY EDWARD MENDELSON

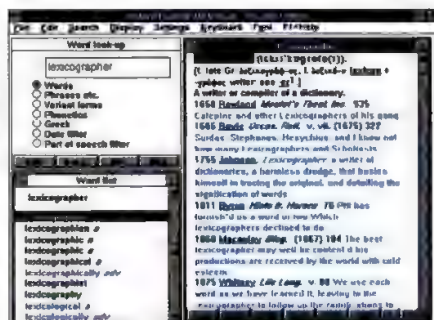
Adobe Type Manager lets Microsoft Windows users work with any of 20,000 scalable Adobe PostScript Type 1 fonts with any printer supported by Windows—including printers that have never even heard of PostScript. PrimeType for

WordPerfect gives anyone with a copy of WordPerfect for DOS access to all of those fonts, and it prints them more quickly than Adobe Type Manager. LaserTools Corp.'s \$99.95 utility runs either as a shell around WordPerfect or as a TSR program. Either

way, the program remains dormant until you print from WordPerfect, when it uses your computer's CPU to convert PostScript fonts to ones that your printer understands. With a reasonably fast computer, you will get faster output with PrimeType than you will from your printer alone.

The PrimeType package comes with 20 fonts—Times, Helvetica, and popular Adobe designs like Tekton and Adobe Garamond. You can install any other Type 1 font on the market. If you have a PostScript printer, you don't need PrimeType for printing, but it's worth having anyway because it does a better job of installing fonts in WordPerfect than any other package does. PrimeType for WordPerfect produces fast, elegant output, and it's the best cure for Windows envy on the market.

PrimeType for WordPerfect; LaserTools Corp., 1250 45th St., Emeryville, CA 94608; 800-767-8004; 510-420-8777; fax, 510-420-1150. List price: \$99.95. Reviewed: November 10, 1992, page 49. Circle 499 on reader service card



Typing a word in OED2's lookup window displays a list of entry words as well as definitions.



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CIRCLE 139 ON READER SERVICE CARD

Borland International Inc.

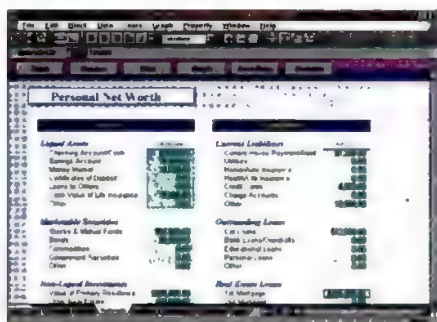
Quattro Pro for Windows

BY CRAIG STINSON

In 1992, Borland International rewarded patient users with a brilliantly designed three-dimensional spreadsheet program. Long on interface innovation and graphical beauty, Quattro Pro for Windows became the first spreadsheet to make three-dimensional modeling an accessible, useful analytic tool. One of the keys to the product's success is a notebook metaphor, in which each worksheet page can be assigned a descriptive name and users can navigate through the set by clicking on page tabs.

QPW also introduced a consistent, well-thought-out use for the right mouse button, which you can click on any worksheet or chart object. The program presents a single dialog box from which you can inspect and modify any of that object's attributes.

For presenters, QPW includes a versatile slide-show facility, complete with light table. For developers, there's an Interface Builder that lets you create menus and dialog boxes without building cryptic tables. And for connections to dBASE and Paradox, QPW includes a Database Desktop module, a subset of the forthcoming Paradox for Windows. QPW makes it clear: Borland deserves to be a



Quattro Pro for Windows is a brilliantly designed, three-dimensional spreadsheet program.

strong player in the Windows spreadsheet market.

Quattro Pro for Windows; Borland International, 1800 Green Hills Rd., P.O. Box 66001, Scotts Valley, CA 95067; 800-331-0877, 408-461-9122. List price: \$495. Reviewed: November 10, 1992, page 162. Circle 500 on reader service card

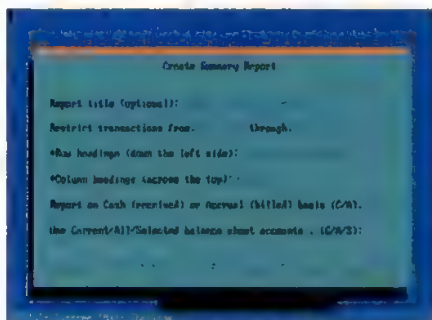
Intuit

QuickBooks

BY THERESA W. CAREY

Here's an accounting program that redefined the low-end category in 1992. QuickBooks will shake many small business owners out of their spreadsheets. Made by the folks who created Quicken, QuickBooks is fairly simple to set up and maintain, free of such terms as *debit* and *reversing entry*. You can get started with QuickBooks in under an hour.

Businesses that have been using Quicken to provide them with reports and tax information can upgrade to QuickBooks to get more power. You can use QuickBooks for accrual or cash re-



Customizing a Profit and Loss in QuickBooks's report takes a few keystrokes.

porting, while easily keeping track of your cash flow needs.

QuickBooks' customizable invoices give you the flexibility to send out bills in a number of formats and then track the money as it comes in. If your business needs to track inventory, or it must record the cost of goods sold, you need something more powerful. But for basic bookkeeping tasks, QuickBooks gets the job done well.

Quicken for DOS, Version 6.0 Quicken for Windows, Version 2.0

BY BILL HOWARD

If you like personal finance software that's simple, effective, and time-saving, nothing compares with Intuit's Quicken for DOS, Version 6.0, and Quicken for

Windows, Version 2.0. Quicken's on-screen displays resemble blank checks and checkbook registers. Type in the payee's name and the amount, hit Ctrl-Enter, and you've written a check. The newest Quicken versions offer an optional no-annual-fee VISA card with both paper and electronic statements (by modem or on-disk). Import the statement into Quicken and your credit card transactions are automatically recorded and categorized via the IntelliCharge link, a Technical Excellence finalist.

Intuit, 155 Linfield Dr., Menlo Park, CA 94026; 800-624-8742, 415-322-0573; fax, 415-322-1013.

QuickBooks; List price: \$139.95. Reviewed: July 1992, page 52.

Quicken for DOS, Version 6.0; List price: \$69.95. Reviewed: November 10, 1992, page 37.

Quicken for Windows, Version 2.0; List price: \$69.95. Not previously reviewed in PC Magazine.

Circle 501 on reader service card

Compaq Computer Corp.

QVision 1024/E

BY BILL HOWARD

If a picture is worth a thousand words, then the time it takes to redraw a picture on your Microsoft Windows display might seem like a thousand years when you have a slow video card. Accelerated video technology adds a noticeable measure of video speed to any PC, even the fastest 486/50s and 486DX2/66s, and it can also extend the life of a two- or three-year-old PC that is bogged down because of its outdated frame-buffer video technology.

If you have an EISA-based PC, Compaq's QVision 1024/E video card is just the ticket for fast video performance. On 50- and 66-MHz Compaq Deskpro systems, the \$375 card produced some of the fastest Graphics Winmark scores PC Magazine Labs has seen. Fierce competition ensures that the top gun is quickly outdone. But even as others post higher benchmark test scores, particularly PCs that have local-bus video, the QVision 1024/E's merits endure, especially the solid Windows drivers and a truly large large-font option that lets you run in 1,024-by-768 resolution without eye-

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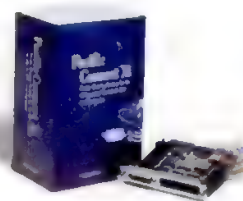
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CIRCLE 071 ON READER SERVICE CARD

The Best of 1992

strain on even the smallest, 14- and 15-inch displays. Compaq also makes an ISA version, the QVision 1024/I, which is also \$375; the EISA version is significantly faster.

QVision 1024/E; Compaq Computer Corp., 20555 SH 249, Houston, TX 77070-2698; 800-345-1518. List price: With 1MB VRAM, \$375. Reviewed: April 14, 1992, page 37.

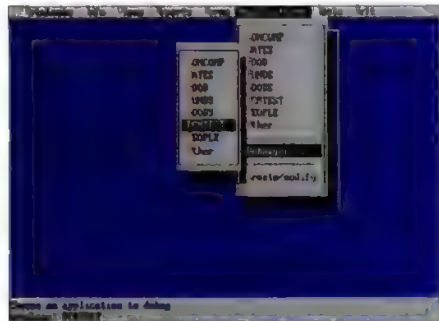
Circle 516 on reader service card

Microrim Inc.

R:BASE, Version 4.0

BY JOE SALEMI

Full 32-bit power, full compliance with SQL standards, and a debugger are some of the many enhancements that make R:BASE, Version 4.0, one of the most



R:BASE 4.0 includes a feature developers have wanted for years: a built-in source-code debugger.

significant database upgrades of the year.

Microrim's R:BASE has followed both the relational database model and the ANSI SQL standard better than any other PC-based database. But a buggy earlier version and distracted management lost Microrim a lot of ground; however, it has rebounded with Version 4.0. The package brings R:BASE into complete compliance with the ANSI SQL Level 2 standard of 1989, and brings full 32-bit power and capabilities to both DOS and OS/2-based databases.

The \$795 package uses DOS4GW, a WATCOM International DOS Extender to access 32-bit memory on 386 and better systems that have a minimum of 2.5MB of extended memory. R:BASE's outstanding applications generator is enhanced in Version 4.0 by a new interactive source-code debugger with trace, watch, and breakpoint capabilities.

R:BASE, Version 4.0; Microrim Inc.,

15395 S.E. 30th Pl., Bellevue, WA 98007; 800-628-6990, 206-649-9500; fax, 206-649-9350. List price: \$795; 5-user Network Pack, \$995; Reviewed: September 29, 1992, page 42.

Circle 503 on reader service card

Intel Corp.

SatisFAXtion Modem/400e

BY FRANK J. DERFLER, JR.

Modems last forever. You'll amortize the money you spend on a modem today over at least five years, so at current street prices it makes sense to invest about \$400 in a modem that has a full suite of capabilities and is backed by a strong company. For those reasons, we recommend Intel Corp.'s SatisFAXtion Modem/400e.

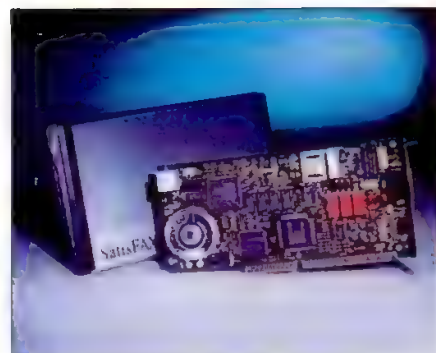
This external modem has all the right specifications. It provides V.32bis signaling at 14.4 kilobits per second and V.42 error control for the data modem, along with 9.6-Kbps fax capabilities. The company has done a good job with the firmware; it isn't on the ROM du jour plan. The modem controls are in the right places, and the front-panel lights are easy to read.

SatisFAXtion Modem/400

BY RICK AYRE

Intel's SatisFAXtion Modem/400 has been one of our favorite fax modem products since it was called the Intel Connection CoProcessor. The difference between the external version—the SatisFAXtion Modem/400/e—and this internal modem is that the latter modem has a coprocessor to process fax translations for your computer.

As it is, the 400/e is the finest fax modem we have seen. It had the highest fax throughput score in our recent fax modem review, and it works well with all of our favorite DOS and Microsoft Windows fax software. Its coprocessor lets users send and receive faxes in the background more smoothly than any



Intel's SatisFAXtion modems come with a full suite of capabilities and a coprocessed fax option.

other PC fax solution.

SatisFAXtion Modem/400, SatisFAXtion Modem/400e; Intel Corp., 5200 NE Elam Young Pkwy., Hillsboro, OR 97124; 800-538-3373, 503-629-7354. List price: Modem/400e, \$549; Modem/400, \$499. Last reviewed: December 8, 1992, page 346.

Circle 504 on reader service card

Addstor Inc.

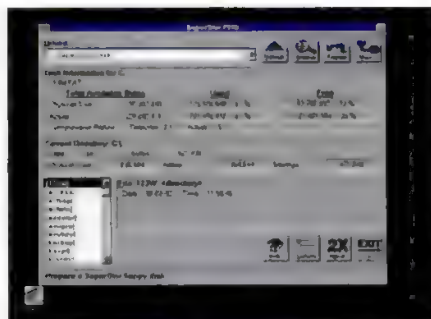
SuperStor PRO

BY RICK AYRE

SuperStor, from Addstor, has long toiled in the shadow of Stac Electronics' Stacker in the real-time compression software category. SuperStor PRO has finally leveled the playing field, and even swings the momentum to Addstor.

Data compression software can double your disk space by compressing your files. The files are decompressed as you need them; it's a tricky business. Because all the data on your disk is stored in a format that only SuperStor PRO understands, many users are squeamish about data compression products.

Now, much of that fear is unnecessary, since SuperStor PRO's menu-driven install program removes



SuperStor PRO's menu-driven install program makes the compression process less uncertain.

much of the uncertainty from the process, and the manual clearly outlines the relevant safety procedures.

SuperStor PRO not only does disk



NEW BREED





486SX/33-\$1999

This Hyundai 486SX-33 can out-muscle those barnyard bovines of cow country. But you be the judge.

Our 32 Megapixel "Longhorn" Local Bus?... or a 1 Megapixel moo cow? Our "faster-than-a-blink" Windows accelerator video processing tied to the speed of your 486 CPU?... or an old-fashioned bottleneck? Our 1MB VRAM controller producing 1024 x 768 ultra-high, non-interlaced resolution?... or their tired cow VGA? Clearly, the prize goes to the Hyundai New Breed.

Compare our standard 128KB of zero-wait state cache with non-cached cows. And don't forget, the Hyundai 433S flexes its processing muscle up to 256KB of cache expansion. This system runs at the head of the stampede!

And we don't just drive the Hyundai stampede, we over-drive it! Double your speed by simply snapping in the Intel Overdrive™ Processor. And our advanced "warpspeed" L2 cache and "Longhorn" Local Bus graphics engine give your upgraded system the 32-bit video and fast SRAM you'll need for your higher-speed 486 CPU.

Hyundai 433S

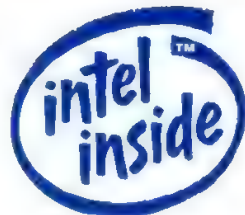
- 33MHz 486SX w/ 8KB integrated cache
- 32-bit VESA local bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Upgradable to 486DX power via Intel Overdrive™ socket
- 4MB system memory expandable to 64MB on system board
- 170MB 19ms IDE HDD, 32KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs, (2.88MB-ready FDD interface)
- 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt and swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 expansion slots, including 1 VESA local bus slot
- 200 watt power supply
- 101 keyboard, 2 button mouse
- Built-in virus protection, front keylock, 2 level password
- MS DOS 5.0 and MS Windows 3.1



Hyundai 433S

Want to talk add-ins? We test our 486 systems with literally hundreds of industry-standard cards and software applications. We test software compatibility on Novell (we're fully certified and a Novell Alliance Program member), Banyan Vines, OS/2 2.0, LAN Manager, and SCO UNIX, plus hundreds of programs running under Windows and MS DOS.

Trouble on the data frontier? Relax. The Hyundai 433S is loaded. A beefy 170MB superfast hard disk, two floppy drives, five external/two internal drive bays, and seven expansion slots mean you won't go hungry for performance. And dressed up with our 14" flicker-free, non-interlaced, color display, the New Breed 433S is the new king of PC country.



Add-In

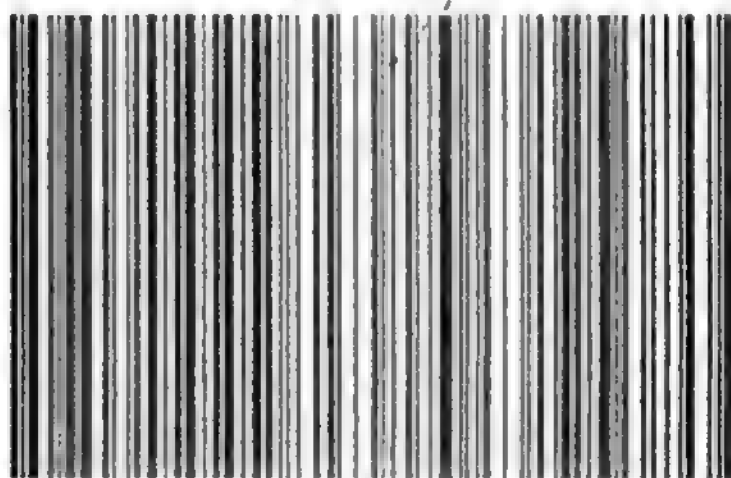
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1. Follow instructions on the other side

Back

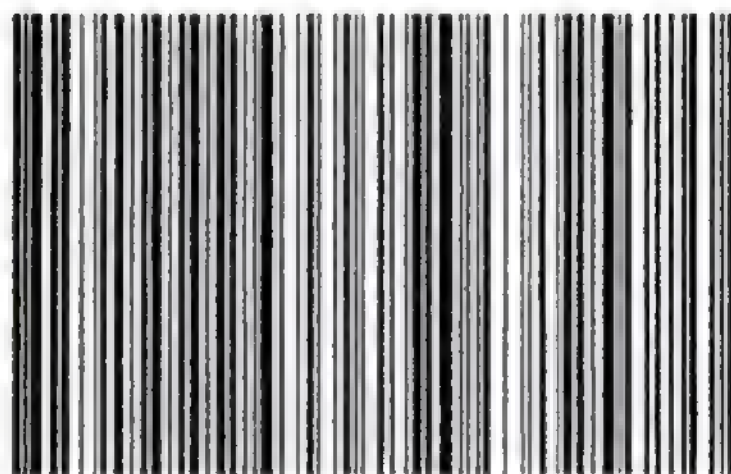
0018-0050Back-0018



Inverted Back

1. Follow instructions on the other side

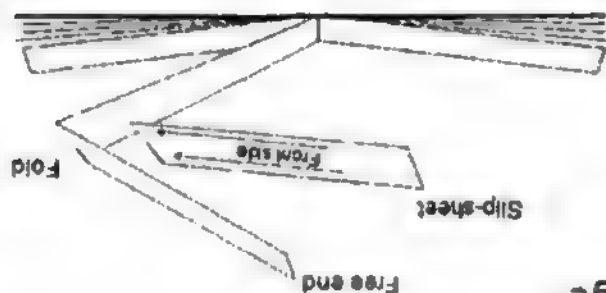
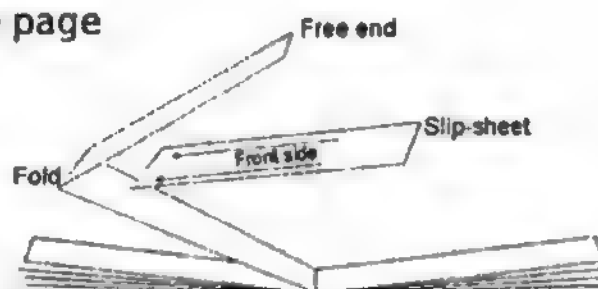
Folded edge of the page



GbsSlipSheet-001

Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

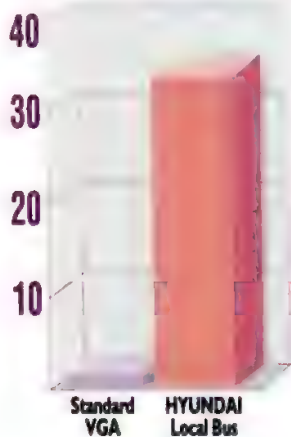


486 STAMPEDE



That thunder you hear on the PC prairie is the New Breed Hyundai 486 stampede. The hardest-charging, price-lean, MIPS-mean herd of computers you'll ever see. We're bringing everything from powerful 66MHz 486DX2 machines to Overdrive-Upgradable 486SX-25 computers. And with our 50MHz 486DX2 desktop PC and 486DX-33 blasters, you can handle today's demanding applications.

WINMARKS



Do something "Longhorn" Local Bus.

That flash you see on the graphics horizon is the image of our Windows processing power triggering the Hyundai 486 stampede.

Your 486 processor was meant to run today's applications. So why rein in all that power? That out-to-pasture, 16-bit VGA card can only deliver 2 Megapixels at best. That's already dated technology. Let her rip with 32-no-blink-bits of "Longhorn" Local Bus video acceleration. And with up to 32 Megapixels standard, believe it, you'll see an incredible difference in Windows performance.

Do something thunderbolt.

Lightning-fast "warpspeed" L2 caching is another max-performance feature that's designed into every Hyundai 486. Thunderbolt write-

back operations blast your DOS, Windows, or OS/2 data into a box canyon of ultra-fast SRAM. Start out with 128KB standard (more than the cow computers), then expand to 256KB to handle today's big applications. Cache hit for cache hit, the Hyundai 486 Family, with 128KB standard caching, delivers twice the MIPS of non-cached cows.

Do something upgradable.

The Hyundai 486 New Breed Family is designed in Silicon Valley, U.S.A., to out-perform the herd.

All of our systems are CPU-upgradable through a single chip via a ZIF or Overdrive socket, so the New Breed lets you double your speed. We won't let tomorrow's 32-bit operating systems blast a hole in your productivity. Just upgrade your Hyundai 486 to any higher-speed Intel 486 CPU in the future.



AND PUT THE OLD BREED OUT TO PASTURE.

Every cow has its day. But it's time to put that milker out to pasture and make way for the Hyundai 486 stampede. It's time to Do Something New Breed®.

Say goodbye to "cow-shed" engineering and mother-board-of-the-month manufacturing. At Hyundai, we're doing U.S.-based, end-to-end, value engineering and manufacturing. That means benchmark-blasting power from the new Hyundai family of 486 Systems.

And with up to 32 Winmarks of Windows processing power, Hyundai's bulletproof, 32-bit 486 Systems are designed and engineered for your high-throughput applications. For instance, *Local Bus Graphics* are standard on every system, from our entry-level computers up through our top-of-the-line desktops. You'll tear through Windows with our razor-sharp, 32-bit processing. Plus, up to 32 Megapixels of mind-bending *GUI acceleration* is standard with every New Breed 486 from Hyundai. And here's more New Breed value engineering. Our expandable, "warpspeed" *L2 cache architecture* is standard on every Hyundai 486 system.

Made-in-America engineering excellence is coming through the gates with the backing of a global high-tech leader. Now Do Something New Breed. And turn the page....





Somewhere east of Sioux City



POWERFUL



\$1799 Hyundai 425S

- 25MHz Intel 486SX w/8KB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Upgradable to 486DX power via Intel Overdrive™
- 4MB system memory expandable to 64MB on board
- 80MB 17ms IDE HDD, 32KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs

- 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2-button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Other hard drive, video, memory, and monitor options available



\$2369 Hyundai 433D

- 33MHz Intel 486DX w/8KB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Processor upgradable via ZIF socket
- 4MB system memory expandable to 64MB on board
- 200MB 12ms IDE HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs
- 14" non-interlaced, ultra-high resolution, .28 dot

- pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2-button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Available in floor-standing server model as 433DT, call for price
- Other hard drive, video, memory, and monitor options available



\$2599 Hyundai 450D2

- 50MHz Intel 486DX2 w/8KB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Processor upgradable via ZIF socket
- 8MB system memory expandable to 64MB on board
- 200MB 12ms IDE HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs

- 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2-button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Other hard drive, video, memory, and monitor options available



\$2995 Hyundai 466D2

- 66MHz Intel 486DX2 w/8KB integrated cache
- 32-bit VESA Local Bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Processor upgradable via ZIF socket
- 8MB system memory expandable to 64MB on board
- 360MB 12ms IDE HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs
- 14" non-interlaced, ultra-high resolution, .28 dot

- pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt-and-swivel base
- 25/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA Local Bus slot
- 200 watt power supply
- 101 keyboard, 2 button mouse
- Built-in virus protection, front key lock, 2 level password
- MS DOS 5.0 and MS Windows 3.1
- Available in floor-standing model with ISA architecture as 466D2T, call for price
- Other hard drive, video, memory, and monitor options available

DO SOMETHING SMART. CALL HYUNDAI DIRECT SALES.

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DOO SOMETHING EXTRA

We'll give you more than you bargained for. When you go with the 486 stampede, from our 425SP to our powerhouse 466D2TE, we give you exclusive *low prices on software*. Our size and reputation allow us to forge alliances with all the major players in the industry, which means we can bring you software specials from firms like Microsoft, Borland, Lotus, and Symantec.

Do something safe.

The PC range war can shake everybody's confidence. Except ours. We're a \$50 billion global company, which means we have the resources to guarantee outstanding service and support. When you buy New Breed technology, you get New Breed service from a world-wide leader.

In addition to our service and support, we have a TQC (Total Quality Care) program that makes us the double-safe buy. Our 18-month warranty on all systems is a soft ride in the saddle.

The bottom line is your satisfaction. Buy the Hyundai 486 stampede, and you get more than New Breed technology. You get New Breed Service that leaves that old breed behind.

NEW BREED SERVICE AND SUPPORT

- One-year, next-business-day, on-site service with all direct orders, followed by 6-month, ship-in warranty on parts and labor.
- 30-day, no-risk, money-back guarantee on anything you buy direct from Hyundai.
- 48-hour turnaround on ship-in repairs.
- Beginners Help Line: 800-933-9917.
- Product spec fax: 800-723-4843.
- 7-days-a-week tech support:
 - 24-hour lifetime tech support: 800-289-4986.
 - 24-hour tech fax: 800-283-4986.
 - 24-hour tech bulletin board: 800-955-5432.
 - Tech support through CompuServe access.

**24 HRS.
7 DAYS.**

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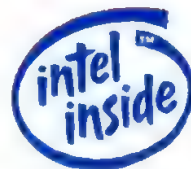


Great deals on optional software!

Hyundai 466D2TE New Breed Power Server

- 66MHz 486DX2 CPU w/8KB integrated cache
- 128KB high-speed L2 cache
- 32-bit EISA architecture
- 8MB RAM standard (expandable to 32MB on system board and 96MB via memory expansion board)
- 32-bit caching SCSI host adapter
- 360MB 12ms SCSI HDD, 256KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs
- SVGA graphics card
- 14" interlaced, ultra-high resolution, flicker-free, color display with 1024 x 768 resolution, .28 dot pitch, 72MHz refresh rate
- Seven 32-bit EISA slots, one ISA slot
- 5 external and 2 internal drive bays
- 300 watt power supply
- Built-in virus protection, front keylock, 2 level password
- 101 keyboard, 2 button mouse
- MS DOS 5.0 and Windows 3.1

\$3995





Hey, do something pronto! Fax your standard (or targeted) system configuration to one of our System Specialists.
We'll spec it out and call you back with a system quote that beats the cows. Or anyone else!

Fax your specs to 1-800-283-4986

Your Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone() _____ FAX() _____

Number of PCs in your current site _____ Brands you have standardized on _____

Other brands you are considering _____

Number of PCs installed 486 _____ 386 _____ 386SX _____ 286 _____

Tell us about your targeted system configuration

CPU Type ☐ 486 ☐ 486SX ☐ 386DX ☐ 386SX ☐ Notebook

Architecture ☐ ISA ☐ EISA

Memory _____ MB installed Cache Memory ☐ 128 KB ☐ 256KB

Floppies ☐ 1.44MB 3-1/2" ☐ 1.2MB 5-1/4"

Hard Disks (IDE) ☐ 100MB ☐ 120MB ☐ 200MB ☐ 250MB ☐ 330MB ☐ 500MB

(SCSI) 3.5" ☐ 360MB ☐ 540MB ☐ 1.2GB

5.25" ☐ 330MB ☐ 760MB ☐ 1.6GB ☐ 2.0GB

☐ Tape _____ MB ☐ Sound Card ☐ Other _____ ☐ Fax/Modem ☐ CD-ROM

Call for more options! Number of PCs you intend to order: _____

Other special needs: _____

Hyundai's recommendation and quote. Based on your input, here's what we recommend: _____

And here's our price: _____

If we don't beat your other quotes, call us.

Call Hyundai Direct at 1-800-933-3445



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Headquarters: San 136-1, Ami-Ri, Bubal-Myun, Ichon-Kun, Kyungki-Do, Korea. Tel: (02) 741-0661/4. TLX : K23955/7. HDETN FAX: (02) 741-0737
Worldwide PC Operations: 166 Baypointe Parkway San Jose, CA 95134 (408) 473-9200

compression, it also comes with Optibase's JPEG image compression software; as well as add an integral disk cache, password protection, the ability to utilize extended memory for storing its device driver, and a set of Microsoft Windows utilities for managing compressed drives. In this software class's feature war, SuperStor PRO now holds the edge.

SuperStor PRO; Addstor Inc., 1040 Marsh Rd., Menlo Park, CA 94025; 800-732-3133; fax, 415-688-0466. List price: \$149.95; upgrade for SuperStor and DR-DOS 6.0 users, \$39.95. Not previously reviewed in PC Magazine.

Circle 505 on reader service card

Panacea Inc.

WinSpeed, Version 1.03

BY JOEL DREYFUSS

Okay, so Windows is never fast enough. We know the solution now: the most powerful CPU you can find and a graphics accelerator card. Unless money is no object, Panacea's \$79 WinSpeed, Version 1.03, may be the best compromise between big bucks and slow Windows.

Panacea has written very efficient drivers for the most popular graphics cards with chips from ATI Technologies, Western Digital Corp., Trident Microsystems, and Tseng Laboratories. Using these drivers with run-of-the-mill video cards, Panacea claims you get a speed boost of 200 to 500 percent. On our own tests, the gains haven't been quite so dramatic, but they're noticeable. Microsoft Windows may not pop like it will with Compaq's QVision 1024/E or an ATI Graphics Ultra Pro, but there's a definite quickening of its step with Panacea's drivers. In many cases, you get Super VGA or 1,024-by-768 resolutions and 256 simultaneous colors at nearly the same speed you had with standard VGA.

WinSpeed will check your video card and install the correct drivers. If you're saving up for the dream machine, Win-

Speed helps make the wait less painful.

WinSpeed, Version 1.03; Panacea Inc., Post Office Sq., #4, 24 Orchard View Dr., Londonderry, NH 03053; 800-729-7420, 603-437-5022; fax, 603-434-2461. List price: \$79. Reviewed: October 13, page 322.

Circle 506 on reader service card

XTree Co.

XTree for Windows

BY DON WILLMOTT

Remember how Microsoft Windows applications were supposed to give us Macintosh-like drag-and-drop functionality? There were a few programs that got the ball rolling, but it still seemed like a dream deferred until XTree for Windows came along.

XTree Co.'s \$99 file manager is a wonderful GUI implementation of its equally capable DOS sibling. It takes care of all your file-management needs smoothly and logically.

Here is an example. Until XTree for Windows came into my life, managing screen-capture files was an enormous hassle. Now, when I capture a screen as a .PCX file, things are actually simple. One click and I view it. Another click and I rename it. Yet another click and I open the network directory tree. Click again and I drag and drop the file into the appropriate subdirectory. Click and drag, and the file is compressed and added to my .ZIP archive. Click and I throw the original into the trash can.

If, like many long-time DOS users, you have had a difficult time leaving the command line behind, XTree for Windows may be the catalyst that

will turn you away from DOS and into a full-time Windows user.

XTree for Windows; XTree Co., 4115 Broad St., #1, San Luis Obispo, CA 93401; 800-395-8733, 805-541-0604; fax, 805-541-4762. List price: \$99. Reviewed: November 10, 1992, page 38.

Circle 507 on reader service card

Zenith Data Systems

Z-Note 325Lc Model 120

BY JOEL DREYFUSS

In a year when most laptops looked and acted alike, Zenith Data Systems' Z-Note portables brought refreshing differences to the crowded notebook market.

After pioneering the market for notebooks several years back, ZDS seemed to lose its way. Now firmly in the grasp of French computer maker Bull HN Information Systems, ZDS has thrown down the gauntlet with this latest group of machines. In the first place, these notebooks are handsome. ZDS enlisted the



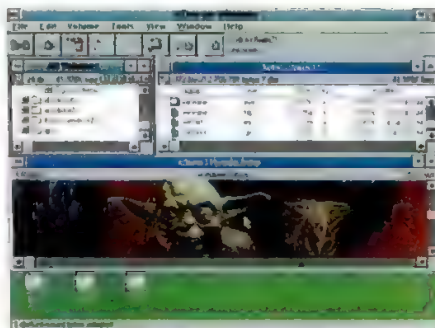
The Zenith 325Lc Model 120's performance on PC Magazine Labs' tests was nothing short of stellar.

help of frogdesign inc., the firm that originally spiffed up the Apple Macintosh line. The result is a nice, clean design that helps the Z-Notes stand out without resorting to outlandish shapes or colors.

But beauty is more than case-deep. The Z-Notes have built-in Ethernet connections that let the traveling professional plug into the office network with ease. There is an accessory bar that lets you plug in an external monitor and other devices but easily detach the Z-Note when you're on the go. And as with NCR Corp.'s notebook, the NCR System 3170, there are several icons near the keyboard that tell you what options have been activated and what the laptop is doing at the moment. The unit is good-looking and useful—not a bad combination.

Z-Note 325Lc Model 120; Zenith Data Systems, 2150 E. Lake Cook Rd., Buffalo Grove, IL 60089; 800-553-0331; fax, 708-808-4434. List price: \$3,999. Reviewed: December 22, 1992, page 290.

Circle 508 on reader service card



With XTree, you can click to view a .PCX file, click again to rename it, and then drag and drop it.

The Best of Abort, Retry, Fail?

By Robin Raskin & Emerson Andrew Torgan

PC Magazine salutes the memorable moments, people, and advertisements of 1992. Now who said we were as stiff as Al Gore?

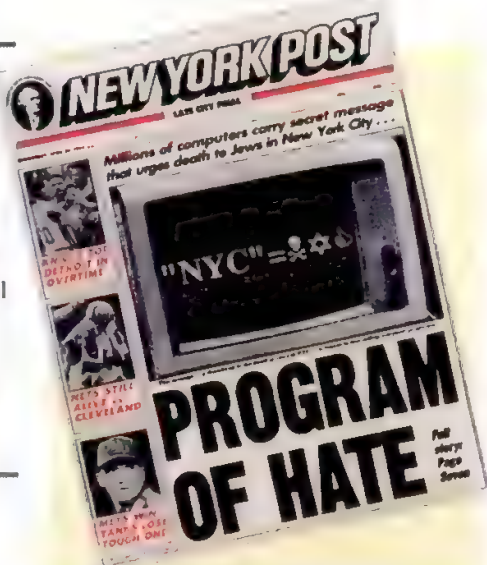
PC Magazine Also Predicts that Ross Perot Will Be Elected in a Landslide . . .

"The Momenta [pen computer] is a brave attempt at the ideal transitional machine. We predict that Momenta will get its legs and be a long-term player."
—PC MAGAZINE, APRIL 28, 1992
(Momenta Corp. liquidated its assets in October 1992.)

The PC Magazine Software Naming Engine

Editors' note: Choose one from column A, one from column B, and one from column C, and there's a good chance you'll name the best-selling software application of 1993. Some are already taken, like **WinFax PRO**. Our favorites are **Multi-FormExecutive** and **JetDrawDeluxe**.

Column A	Column B	Column C
Auto	Base	Deluxe
Hyper	Draw	Direct
Jet	Fax	Easy
Multi	Form	Executive
Power	LAN	Expert
Quick	Master	Fax
Soft	Power	Gold
Super	Pro	PC
Turbo	Vision	Plus
Ultra	Win	Pro
Win	Word	Win



The Captain Queeg Award For Outstanding Paranoia in a Newspaper Headline

The New York Post (April 29, 1992) breaks the story that Microsoft Windows 3.1 "contains a secret anti-semitic message."

We say: 🐘 🐘 🐘 🐘 🐘 🐘 🐘 🐘 🐘 🐘

Product Names You'd Expect to See in Your Pharmacy—Under The Counter

Contura	Vivace
ProLinea	FrimLoc
ProSignia	N/Joy
Performa	Porky's Outlook

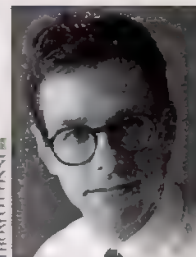
Henny-Penny! The Sistine Chapel's Ceiling Is Falling!

"SAN JOSE, CALIFORNIA, 1992 March 2—The Michelangelo virus is one of the most disastrous viruses ever, with damages from the scheduled attack of the virus on March 6 possibly mounting into the millions of dollars. . . ."

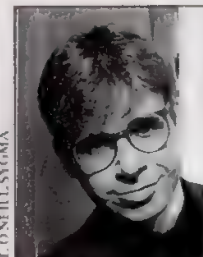
—ELECTRONIC BULLETIN
FROM DATAQUEST
Wrong! Thank you for playing.

Separated At Birth?

Leona Helmsley and the Joker...Daryl Strawberry and Dino the Dinosaur...
Like Spy Magazine, we happen to think that a few people in our industry were snatched from the nursery.

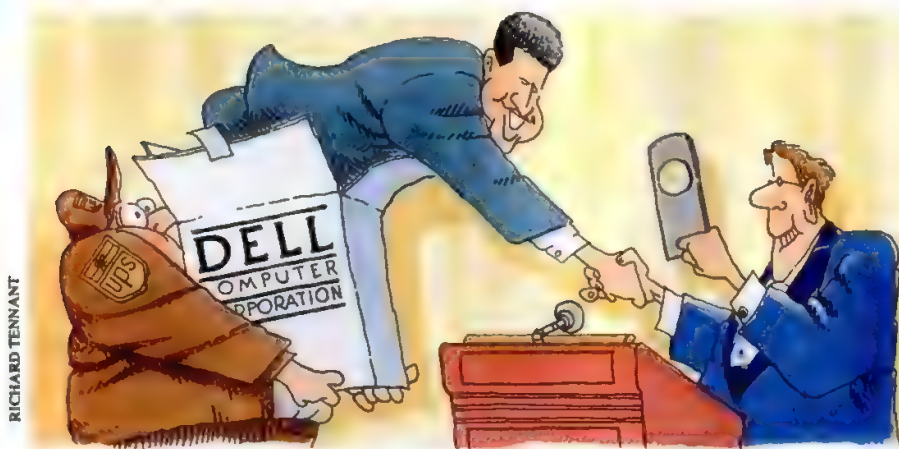


"HONEY, I BLEW UP THE MAGAZINE"
Michael J. Miller



"HONEY, I BLEW UP THE KID"
Rick Moranis

Michael Dell, direct marketing whiz, accepts his Teck Ex award from PC Magazine



RICHARD TENNANT

Word of Mouth:

"While we liked developing Windows applications, we never inhaled."

—Borland's Philippe Kahn
on the company's decision to support
OS/2 as well as Windows

"To crash OS/2, you have to stay up night and day to build a terminator disk. Windows comes with that built-in."

—IBM's James Cannavino
on Microsoft's Terminator
program which crashes OS/2

"I could not say this a year ago, but they are even less clear than we are on their future direction."

—Microsoft's Steve Ballmer
on IBM's alliance with Apple

"IBM created its own Amway program, having its 344,000 employees sell to neighbors, friends, family. If they announced it on April Fools' Day, I would have only half believed it."

—International Data Corp.'s
Lee Levitt on IBM's employee
incentive program for OS/2

"Somehow, we could not locate or could not retrieve the registration database for the existing OS/2 users."

—IBM Personal Systems assistant
general manager Lee Reiswig on the
paperwork that the company requires
for an "automatic" OS/2 upgrade

"I called an 800 number [about OS/2 development], and it took about a week to get through. The first woman I spoke with didn't even know what OS/2 was. I finally talked to a guy who said he'd get back to me in 24 hours, but I still haven't heard from him."

—Chrystal Point president
Chris Stephens on dealing with
IBM's bureaucracy

"There are three problems with standards: greed, ego, and committees."

—Echelon Corp.'s Ken Oshman

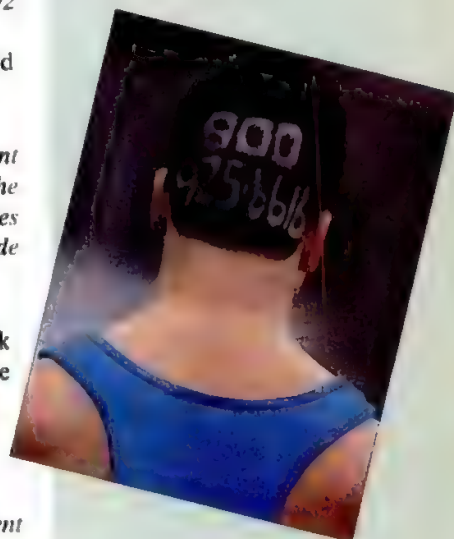
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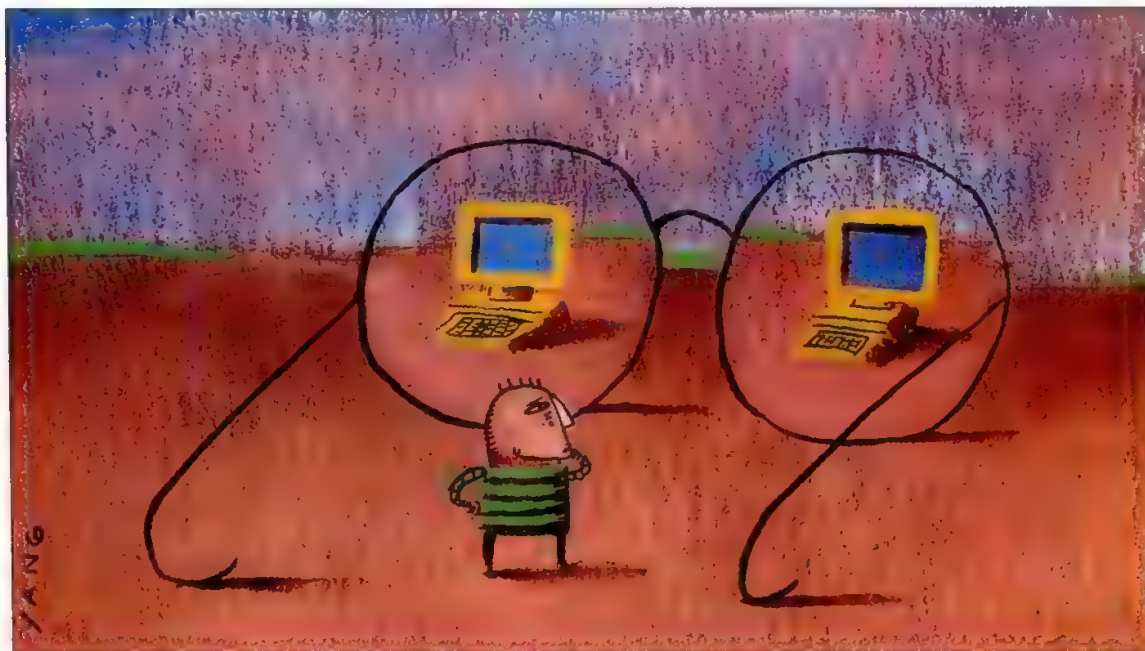
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VIDEO TECHNOLOGY

Making a Choice In an Era of Change



Two eternal truths define the microcomputer market. The first is the dizzying rate of change, which promises an endless stream of new products marching on and off magazine pages and computer-store shelves. Yesterday's technological darling becomes tomorrow's orphaned kludge in what seems like the blink of an eye. The constant shifts in the marketplace lead directly to the second truth: Most people suffer from decision gridlock when buying new computer equipment. Nowhere is this more evident than when it comes to graphics boards.

Should you stick with the frame-buffer board that most likely came with the PC you bought, even though such a design has little intelligence and relies heavily on the system CPU? Or should you move up a notch to graphics accelerators, which build in specific graphics functions and off-load some of the processing burden from the CPU? Or perhaps you need a co-

Whether you're a DOS lover or a Windows power-user, *PC Magazine's* graphics technology survey will help you pick the best board for your needs.

by Alfred Poor

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processed graphics board, which offers the extra advantage of programmability. And once you have determined which class of video board you need, you have to think about other factors, such as the minimum resolution you can live with and how many colors you'll need the board to be capable of displaying.

Finally, if you have the option of upgrading your entire system at the same time as your graphics board, you need to consider whether it makes sense to move from your current ISA, EISA, or Microchannel (MCA) machine to a VESA (Video Electronics Standards Association) local-bus model. The VL-Bus design boosts performance by providing peripherals, such as video controllers, access to a CPU's 32-bit bus running at full clock speed. And we won't even bring up the issue of Intel's proposed PCI (Peripheral Component Interconnect) local-bus standard—yet. (For a detailed discussion of local-bus architecture, see the story "Local-Bus Technology: Video Takes a New Route" in *PC Magazine's* October 27, 1992, issue.)

Which combination makes the most sense for you? Much of the answer depends on what you want to do with your PC and how much money you have to

spend. The fact is that there is no single graphics adapter that is best for all situations. There are basically four different types of users, all of whom have fundamentally differing needs based on the kinds of applications they run. The decision about which board you should buy will ultimately rest upon the way you define your needs.

WHAT'S YOUR TYPE?

First, there is the DOS diehard. You use Microsoft Windows rarely, if ever, and instead rely on programs that simply use standard VGA character and graphics modes. Although you may venture into 800-by-600 resolution on occasion, you're more at home in applications such as WordPerfect, Microsoft Word, Lotus 1-2-3, or even Microsoft Flight Simulator—at the standard VGA resolution.

Or perhaps you fall into the second category: Windows users with modest ex-

pectations. You run applications at VGA or 800-by-600 resolution, using no more than 256 colors at a time. All that you really want is a little more screen real estate in order to view a larger amount of your spreadsheets or preview your documents.

But maybe—if you belong to the third category—you push your GUI (graphical user interface) a bit harder and use a 16- or 17-inch monitor at resolutions of 1,024-by-768 (or higher) or work with images in color depths of 15 to 24 bits per pixel. Or perhaps you fit into fourth category and are a DOS-based CAD user who needs fast, high-resolution adapters with drivers that support your particular CAD package.

To help you figure out which type of board best suits your needs, we look at the available options and provide an analysis of graphics adapters across categories (and by chip in each category), as well as across the ISA, EISA, and VL-Bus architectures. In the following section, "Bringing Windows Up to Warp Speed," we provide a more focused analysis of ISA-based graphics adapters; the review criteria for these boards was that they accelerate Windows performance and cost less than \$1,000.

More strongly than any other sector of the graphics-board arena, the Windows accelerator products illustrate the incredible rate of change in the marketplace: Ten new accelerator chips were represented among the 37 products reviewed, and 13 more are scheduled to ship within the next six months. Compare that with our first roundup of graphics accelerators that was published less than a year ago ("Graphics Accelerators: Pump Up the Power," in the March 17, 1992, issue of *PC Magazine*), when just 5 accelerator chips defined the market. For a summary of accelerator chips that appear on the boards in this story, as well as those that will be on boards in the near future, take a look at the sidebar "What the Chips Can Do."

Our Contributors: LORI GRUNIN and JENNIFER ZAINO are associate editors in charge of graphics and hardware products, respectively. JEFF MACE and MIKE ZULICH are project leaders in charge of graphics and hardware product testing, respectively. ALFRED POOR is a contributing editor to *PC Magazine*. ROCK MILLER and JOHN R. QUAIN are frequent contributors to *PC Magazine*. BEN MYERS of Spirit of Performance, a Harvard, Massachusetts-based consultancy, is the lead developer of PC Labs' Windows Benchmark Tests, Release 3.1.

APPLYING THE NUMBERS

Our analysis of benchmark tests results for this section of the story is focused on the best results in a category (as defined by chip and support for a particular bus) rather than on the performance of individual products in each category. This provides the most useful picture of what a good implementation of a well-designed chip or driver can achieve. Because this first part of the story is a technology survey rather than a product review, we have included in our analysis some products that were not yet shipping. We have also included prototype designs from original equipment manufacturers who will not ship directly to end users.

To find out what works best for each of the four types of users, we ran a selection of 9 frame-buffer, 37 accelerator, and 10 coprocessed boards through three sets of tests: the DOS video test component of the PC Magazine Labs' Hardware Benchmark Tests, Release 7.0; Windows Benchmark Tests, Release 3.1, for all of the resolutions and color depths supported by each board; and our newly updated AutoCAD performance tests. Our test-bed for the ISA- and EISA-based boards was a Compaq Deskpro 386/25M EISA machine equipped with 8MB of RAM and a 310MB hard disk. Micronics Computers supplied its 486/33 VL-Bus motherboard for the local-bus products we tested. The results were obtained using the graphics drivers supplied by the vendors with their boards.

In order to provide a brief glimpse into performance of the same graphics chip across architectures, we obtained a few of the test cards (for four types of chips) in versions for multiple buses. We tested both the \$375 ISA-based Compaq QVision 1024/I and the \$375 EISA-based Compaq QVision 1024/E accelerators, as well as the Orchid ProDesigner IIs/ISA (\$199 with 512K of RAM and \$249 with 1MB) and the \$399 Orchid ProDesigner IIs/EISA frame buffers. We also saw Mach 32-based accelerator cards from ATI, in their ISA and VL-Bus versions, respectively: the ATI Graphics Ultra Pro (\$499 with 512K of RAM and \$599 with 1MB) and the ATI Graphics Ultra Pro VLB Mach 32-V (which wasn't shipping to end users at press time).

Both Diamond Computer Systems



EDITORS' CHOICE

- **ATI Graphics Ultra Plus**
- **Metheus Premier 1280NI**
- **NDI Volante AT600 Plus**

Selecting an Editors' Choice in a market where the only constant is change can be a daunting task. Chances are that in the next three months some upstart product will overtake products released only weeks ago. Nonetheless, we'll post today's Blue

Plate Specials—boards that we feel are the best choices to make if you have to do your choosing today. It's up to you to decide whether to opt for a proven product, buy the cheapest board possible to tide you over until the accelerator dust settles, or take a risk on today's speed demon (be it riding the ISA bus or the local bus) and hope that the company ships the drivers you need bug-free.

The ATI Graphics Ultra Plus (\$499), based on that company's new Mach 32 accelerator, may not be the highest-throughput board we tested, but it was the top performer that caused the least hassle and supplied an adequate selection of stable drivers. In addition, it managed to balance good Windows, AutoCAD, and DOS performance.

If you're willing to sacrifice a little throughput—especially when running DOS applications—Metheus Corp.'s less-expensive Premier 1280NI (\$399) and National Design's Volante AT600 Plus (\$395) are excellent deals. At the top of the generally-acceptable class of S3 911/924-based boards, these two cards offer solid Windows and AutoCAD performance and robust drivers. Given that the two boards are virtually identical, this performance similarity comes as no surprise.

Three boards deserve honorable mention for their excellent performance. Pycon's WinJet Edge Graphics Accelerator (\$459) blazed past the competition at running Windows tasks (while doing a better-than-average job of running DOS), thanks to the magic of Chips & Technologies' Wingine/82C481 chip set. Unfortu-

nately, at testing time it was a bit too immature and lacked the full-spectrum of drivers necessary to make it a good all-purpose board.

Similarly, the two newly released (at test time) boards based on S3's 801 chip—NDI's Volante Warp10 (\$299) and STB Systems' PowerGraph X-24 (\$249)—proved harbingers of things to come with their fast speeds and attractive price tags. They also suffered from driver problems, however. By the time you read this story, the PowerGraph X-24, the Warp10, and the WinJet may be ready for prime time.

If our Editors' Choices seem a bit too steeply priced for you, and you're not quite ready to take a risk on the newly minted Warp10 or the PowerGraph X-24, Diamond Computer Systems' \$249 SpeedSTAR 24X and Western Digital Corp.'s \$249 Paradise Accelerator Card for Windows give you more of a price/performance compromise without the sacrifice of driver stability. Video Seven's \$159 WIN.VGA is about the least expensive board you can buy that will show you *any* speed increase in Windows yet still function properly most of the time.

Keep in mind that many of the boards that we looked at for this review will have undergone driver, accelerator chip, and RAMDAC face-lifts by the time you read this. In order to make the best, most well-informed buying decision in such a rapidly changing market, you will need to analyze a card's specifications and a company's history of providing good driver support.

H I G H L I G H T S

Graphics Adapters

BUYING a new graphics card can do more to improve display performance than upgrading your CPU.

FRAME BUFFERS have little intelligence, but for DOS applications—which put relatively low demands on the system CPU—they are attractive and inexpensive choices. As a class, they also tend to perform better on our DOS VGA tests than do smarter accelerators or coprocessors. On the ISA bus, the fastest chip we tested under DOS was the Cirrus Logic GD5422, but we saw local-bus chips that were almost twice as fast.

FIXED-FUNCTION accelerators take some of the load off the CPU by building in functionality for specific graphics functions, such as BitBlt operations and line draws. That makes them a better choice than frame buffers for environments that put a heavy load on the system CPU, such as Windows.

Most of these products cost around \$300 to \$500, and many are based on chips from S3.

ACCELERATORS proved able performers in many situations, including Windows at VGA and Super VGA resolutions, in both low and deep color modes. For VGA performance, the quickest dumb frame buffer we tested only delivered one third the speed of the fastest accelerator, which was based on ATI's Mach 32 chip.

GRAPHICS COPROCESSORS are able to serve as CPUs but are instead dedicated to calculating display image data. The most famous family of coprocessors is Texas Instruments' TI TMS34010 and TI TMS34020 series. TI's TMS34020 boards justify their high price by offering such advantages as top performance in AutoCAD. But the performance of TMS34010 in AutoCAD is often matched by that of less-costly accelerated offerings.

and Micro-Labs sent Tseng ET4000-based cards for the ISA bus: the \$229 Diamond SpeedSTAR 24X Graphics Adapter and the \$225 Micro-Labs Ultimate VGA/TrueColor frame-buffer boards (which both support 16.8 million simultaneous colors). Tseng Laboratories itself supplied us with a VL-Bus prototype board that implements its new ET4000/AX Rev G frame-buffer chip, as well as one that is based on its new ET4000/W32 accelerator. (Since Tseng only sells to graphics-board manufacturers, you won't be able to purchase these from the company directly.)

We provide the bus comparison information for users who are merely curious about how performance may change respective to environment, as well as for those who are seriously considering the purchase of a new system and want to maximize display performance.

UPPING THE ANTE

Before tackling the issue of which graphics adapter is most suited to your needs,

it's important to understand the different factors that affect display speeds. Then we can explore some of the solutions that vendors have designed to solve these problems and, finally, we can look at how these different solutions perform.

Display resolution is one of the most important factors that affect performance, because increased resolution results in an enormous increase in the amount of data that a display card has to handle. We've come a long way from CGA's 640-by-200 black-and-white graphics resolution, which required moving only 128,000 pixels, or just 16K of information, to and from the screen. (At one bit per pixel for black or white, 640 times 200 equals 128,000 pixels, and 128,000 divided by 8 bits per byte equals 16,000 bytes.) Today, 800-by-600 Super VGA resolution has become a widely accepted minimum display configuration. Many users—particularly those with 17-inch-or-larger monitors running Windows or CAD programs—have switched to 1,024-by-768 resolution and beyond.

The price you pay for this increased detail is more work for your computer and its components. The Super VGA 800-by-600 resolution pushed the pixel count to 480,000. In 1,024-by-768 mode, the count rises to 786,432 pixels. Adapters that support 1,280-by-1,024 resolution are capable of displaying more than a million pixels per screen—1,310,720, to be exact, and that's a million more pixels than are available in standard VGA mode.

Clearly, graphics adapters have a lot of work to do to handle all these pixels at one time. But there's another factor in this equation: color. To display its four colors, a CGA graphics board had to drop down to 320-by-200 resolution, which required 16K (64,000 pixels, 2 bits per pixel, and 8 bits to the byte). In contrast, a 1,024-by-768 screen with 24-bit-per-pixel true-color capabilities requires 2.36MB.

Finally, graphics boards today have to work harder to satisfy current refresh-rate (or vertical scan-rate) requirements. Slower vertical refresh rates (or vertical scan rates) are more prone to causing flicker on displays than faster ones. Today, VESA standards recommend a 72-Hz refresh rate for 800-by-600 displays, but not so long ago, 60 Hz was the norm. Although the increased scan rates make the display easier on the eyes, the speed-up is a little harder on the video cards, which have to be able to run faster in order to produce the higher scan rates. The jump to 72 Hz represents a 20 percent increase in scan rate, which means that a display adapter with a 72-Hz refresh rate has to send out its data in the time that one with a 60-Hz refresh rate handles only four-fifths of the same data.

THE SOLUTIONS

Any one of these factors would be trouble enough, but the combined challenge of moving data for more pixels—with more colors per pixel—at faster refresh rates than ever before is immense. It's the equivalent of trying to drive almost 150 different CGA images at the same time with a single card.

One part of the solution is to have system CPUs that are capable of operating at faster clock speeds than the original IBM PC. But the impact of CPU speed is smaller than you might think. The dif-

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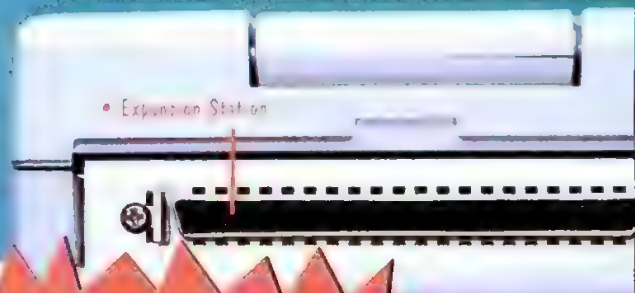
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ference between the 4.77-MHz clock speed of the old 8088 processor and the 50-MHz speed of today's 80486 chips is still only about a factor of at least 50, which leaves a long way to go to make up the difference required to handle the three-times greater load. Also keep in mind that while CPU power and speeds have increased, our applications have grown in their demands on the CPU. Even at low resolutions, Windows can bring a 16-MHz 386SX to its knees.

Even Intel's new Pentium chip (as a faster CPU) is limited in terms of what it can accomplish toward improving your video. Assuming that the Pentium provides double the performance of a 486DX/50, the new chip can still do no better than double the performance of the display; and it remains to be seen whether the Pentium will even make that much of a difference. Clearly, we need more help than just a faster CPU to get these pictures up on our screens as quickly as we'd like.

You will find that on our tests, the best performance times for a given type of chip may remain fairly constant across resolutions and color depths ranging from VGA's 640-by-480 at 16 colors through 1,024-by-768 at 256 colors. There may be some variation in performance for specific cards, but that is often a matter of variation in the optimization of its different drivers for those modes.

As you increase resolution and color depths beyond 1,024-by-768 at 256 colors, however, you will find that performance differences can start to appear. As long as a product can carry the load, performance numbers will remain fairly steady. But when a board reaches its limits, you will most certainly encounter what Joseph Curley, director of marketing at Tseng, refers to as "falling off the cliff." At the point that a board becomes overloaded, its performance falls off sharply. This is most pronounced with frame-buffer designs, though accelerators are also prone to the same effect sooner or later; coprocessors tend to maintain performance throughout the range of resolutions and color depths currently found on PCs.

DISPLAY ADAPTERS FOR DOS

If you intend to stick with DOS applications, you will find that your solutions are

a bit different from the other groups of users considered here. Given the relatively less-demanding nature of DOS text applications—as well as most, if not all, DOS-based graphics programs—the load placed on the system's CPU is smaller than the load created by more taxing GUI environments.

The DOS VGA benchmark tests provide the best indication of the type of card

*It remains to be seen
whether Intel's Pentium
chip will double the
performance of the display.
We need more help than
just a faster CPU.*

suited for these tasks. In spite of all the high-speed (and sometimes expensive) cards included in the test group, the highest throughput on the DOS video tests was produced by graphics adapters built around VGA frame buffers—the least powerful designs of all.

The original VGA chips were frame buffers; their task was simply to catch a screen full of data from the CPU and squirt it out to the monitor as needed. This meant simply handling a stream of data that described each pixel individually for every screen.

LOW-COST SOLUTIONS

The biggest advantage of frame-buffer boards is that they are inexpensive to design and build. Since the bulk of the processing is done by the CPU, the VGA chip can be relatively simple. As a class, these cards provide the lowest cost alternatives, selling for as little as \$60 to \$150 from some mail-order houses.

Some manufacturers have taken the approach of adding only minimal intelligence to these designs, which makes it possible for the cards to respond faster to certain instructions from the CPU than they would without it. For example, the Cirrus Logic (formerly Acumos) GD5422 and GD5402 VGA chips—used in Boca Research's \$235 SuperX VGA, STB's \$179 Evolution VGA, and STB's

\$89 Mach 512VGA (the GD5402)—have hardware cursors and pipeline caches to speed access to video RAM, in addition to 50-MHz video-memory clock frequencies. (The SuperX VGA and Evolution VGA each come with 1MB of DRAM, while the Mach 512VGA includes 512K of DRAM.) Tseng's ET4000 is also a frame buffer—known for its speed—which uses a read/write cache to boost performance. The features are still less than those of fixed-function accelerators (see below), but they provide impressive performance in VGA modes.

On the ISA bus, the fastest chip of all under DOS was the Cirrus Logic GD5422; the chip proved capable of generating results of 6,020.05 thousand graphics operations per second on our test. Also low-priced and equally capable are ISA boards based on the ET4000 frame buffer, such as the Orchid ProDesigner IIs, the Diamond SpeedSTAR 24X Graphics Adapter, and the Micro-Labs Ultimate VGA/TrueColor, with only a fraction of a percentage-point difference between the best ISA-based ET4000 scores and those of the GD5422-based line. (These boards also come with 1MB of DRAM.) When it comes to DOS applications, boards based on frame-buffer chips present an outright bargain. If these boards can satisfy your needs, it makes little sense to pay higher prices for more powerful designs.

While great for vanilla VGA, frame buffers are susceptible to degraded performance at higher resolutions and color depths. They have no way to accept condensed data from the CPU and instead rely on the computer's processor to send all data for each individual pixel. This not only eats up CPU time, but the ISA bus, with its 16-bit-wide data path and 8-MHz clock frequency, becomes a bottleneck.

COMPARING BUS TYPES

Comparing the DOS video results across different buses yields some interesting information. We had two pairs of chips available on an EISA and ISA version of two boards: the Compaq 128084 chip (a fixed-function accelerator) and Tseng's ET4000 chip. In both cases, the EISA board was faster than the ISA version, but not by a significant margin. The EISA-based Compaq was about a third faster than its ISA sibling, but the per-

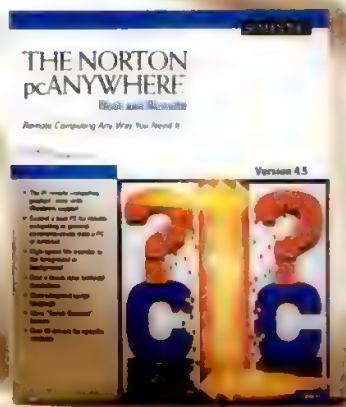
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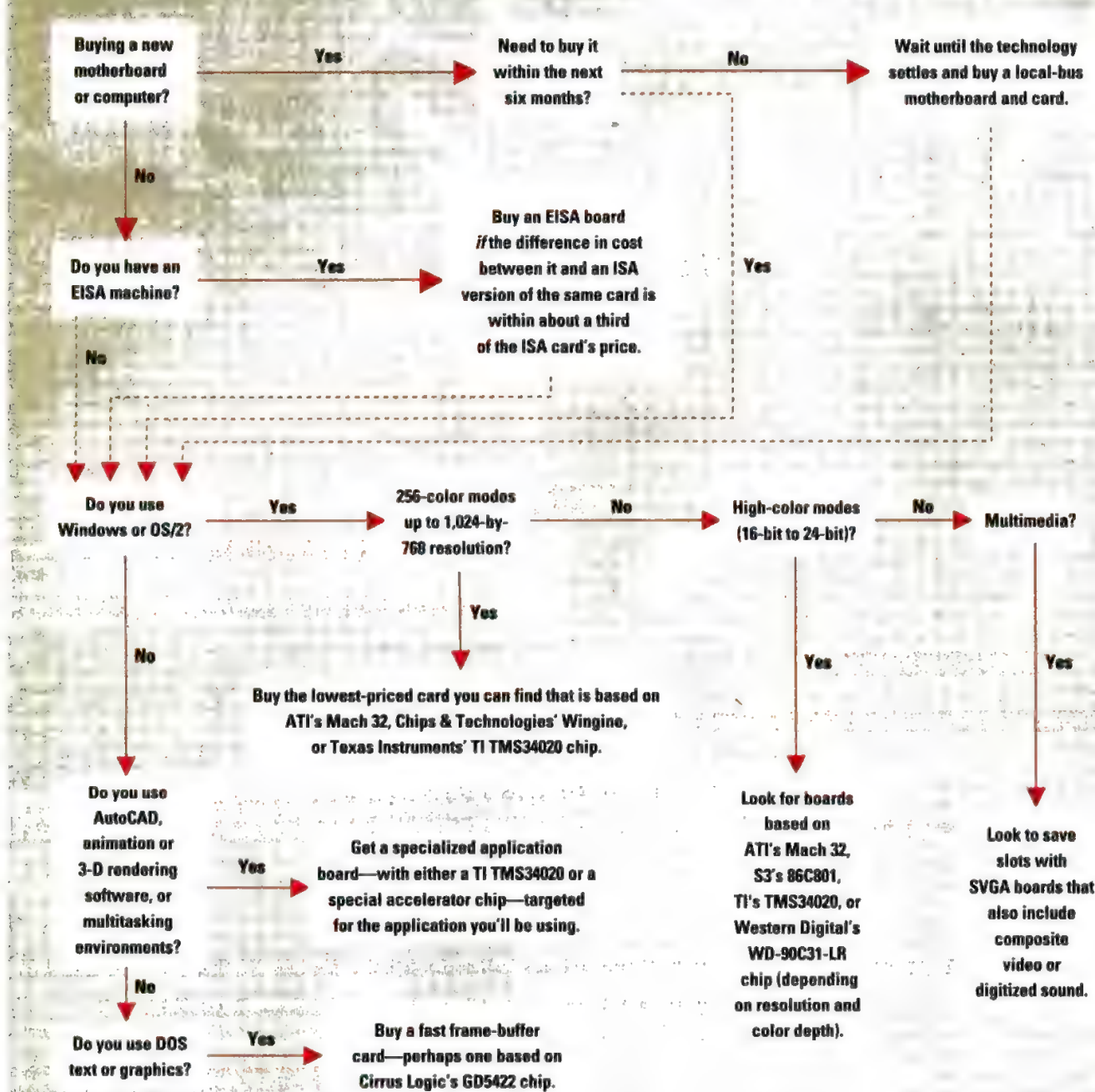
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formance results for the two Tseng-based designs—the ProDesigner IIs and ProDesigner IIs/EISA—were within a scant two percentage points of each other. If you own an EISA machine and spend most of your time in the DOS environment, these results suggest that you must consider carefully whether the added boost you can get with an EISA frame-buffer design is worth the potentially higher cost.

VL-Bus graphics adapters, however, provided a striking increase over their ISA-based counterparts. (The VL-Bus graphics boards were tested on a faster 486/33 system from a different manufacturer; thus, only the most general of comparisons can be drawn between ISA and VL-Bus performance.) A Tseng-made prototype VL-Bus card uses a revised version of the company's ET4000 frame-buffer chip that has been modified to sup-

port local-bus technology: the ET4000AX/Rev G. This essentially tied for the fastest DOS video time of all the boards that were reviewed here—regardless of chip type or bus design. This board was also 82 percent faster than the fastest board with an ET4000 chip on an ISA bus.

The ET4000/AX Rev G chip ran neck and neck with the Tseng-made prototype VL-Bus card that employs the vendor's

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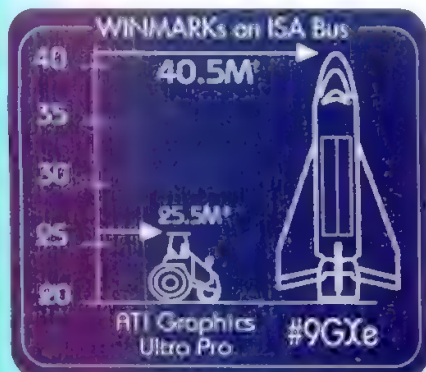
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new ET4000/W32 accelerator. The ET4000/W32 provides 32-bit image transfers and a full range of accelerated features, including BitBlts (bit-block transfers); clippings; font caching; hardware cursor support; and pattern, polygon, and area fills. The close results are a little surprising, only because accelerator chips generally don't do as well as their frame-buffer counterparts on DOS level tests. (For other ISA/VL-Bus board pairs of fixed-function accelerators, you'll see that the performance increase for the VL-Bus versions were most often equally as dramatic.) Clearly, for DOS applications, VL-Bus pays off for graphics.

LOW TO MIDRANGE WINDOWS

Working in a GUI in VGA or 800-by-600 resolution and at either 16 or 256 colors puts a slightly heavier load on the computer system than straight VGA modes, but the extra bits per screen are probably not as significant a factor as is the load a graphical environment such as Windows puts on the system CPU. Because of that load, there's less processing power available to give to display tasks, so you might expect that "smarter" display adapters would do better for the applications at this level.

Our Winbench results bear this out: Of the products tested, fixed-function accelerators performed the best in these modes. Fixed-function accelerators (commonly known as accelerators) get their name from the fact that they are hard-wired to execute only certain specific instructions. These instructions result in the chip performing the calculation routines that produce display data, so the CPU doesn't have to send the pixel-by-pixel data. The routines that are automated in this way generally include simple procedures such as line drawing, BitBlt operations (which are used to move part of the image from one block of pixels to another), and area fills. But not every chip accelerates every one of these functions. For example, the Weitek 5186 chip found on Kingston Technol-

ogy's inexpensive \$149 View Rx doesn't handle any fills or clipping algorithms.

Fixed-function accelerators greatly reduce the amount of data sent by the computer's CPU to the graphics board. This means that less CPU time is taken up by computing display information, and less time is required to transfer this information across the expansion bus.

*Fixed-function
accelerators greatly
reduce the amount of
data sent by the
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graphics board.*

and-a-half-old 86C911, which handles 16-bit image transfers; the newer 86C924, which supports this, as well as 24-bit color; and the recently introduced 86C801, 86C805, and 86C928 chips, which support 32-bit image transfers and 24-bit color. The 805 and 928 chips are both optimized to work with the VL-Bus architecture. (For this story, the only S3-based VL-Bus design we saw was Diamond's Stealth 24 VLB board, which uses the 805 chip and which the company expects to sell for \$249.) ATI's new Mach series chip, the Mach 32, is a 32-bit chip designed to work with local-bus video configurations, as well as with ISA bus cards.

Other accelerators include Chips & Technologies' 82C481, Tseng's ET4000/W32, the Weitek 5186, and Western Digital's WD-90C31-LR. Cardinal's Warp-Speed (priced at \$599 with 1MB of memory) should also be shipping by the time you read this; it will be the first board out to be based on Weitek's new Power 9000 graphics chip, a high-powered migrant from the SPARCstation.

While fixed-function accelerator products are generally more costly than frame buffers, prices are coming down. The majority of products in the accelerator review portion of this story still sell for \$300 to \$500 with 1MB of RAM, but we did see some accelerator boards priced at \$250 or lower. The honor of be-

ing the lowest-priced though not the speediest accelerator in the group goes to the \$139 Galaxy 2000 from Celerite Graphics, equipped with 1MB of DRAM and based on the Primus P2000 chip.

ACCELERATOR ADVANTAGE

If you're working in 640-by-480 or 800-by-600 resolutions at only 16 colors, ISA-based accelerator products that provide drivers for these modes are, by and large, faster than ISA-based frame buffers. On our Graphics Winmark test, the best frame buffer delivered only 2.45 megapixels per second in VGA mode, which is approximately a third of the throughput of the field-leading Mach 32 chip (which scored 6.45 at this resolution).

Up the number of colors to 256, and the fastest scores for the ISA bus were delivered by an accelerator chip, with Winmark test results approaching 9 megapixels per second at 640-by-480 and 800-by-600. The board that produced these results, Pycon's \$459 WinJet Edge Graphics Accelerator, uses C&T's 82C481 fixed-function accelerator in combination with the company's Wingine chip (which provides the VGA capabilities in addition to linear frame-buffer support). Not so far behind was the Mach 32 chip, with test results in the 6.50 range for the ATI Graphics Ultra Plus (\$399 with 1MB) and the ATI Graphics Ultra Pro (\$599).

For accelerators (and coprocessors), drivers are often key to achieving high performance—often more so than memory or other hardware functions. The most technologically advanced board will not outperform a simple design if its drivers fail to take advantage of the board's features. Most graphics-board vendors continually offer newer drivers as performance upgrades for existing boards. Also, third-party vendors such as Panacea (Londonderry, New Hampshire, 603-437-5022) offer software drivers to boost the performance of certain graphics boards; Panacea's \$79 WinSpeed V.1.02A provides increased performance for adapters using various chip sets from ATI, Trident, Tseng, Video Seven, and Western Digital Corp.

Across the board, the ISA-based accelerator cards we tested (most of which are still based on one of the S3 chips)

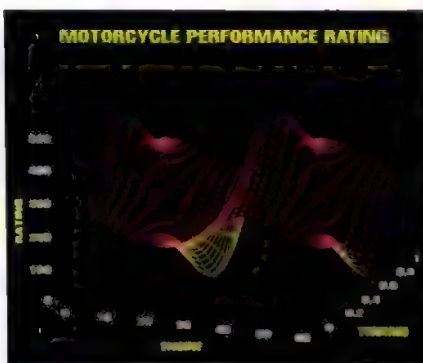
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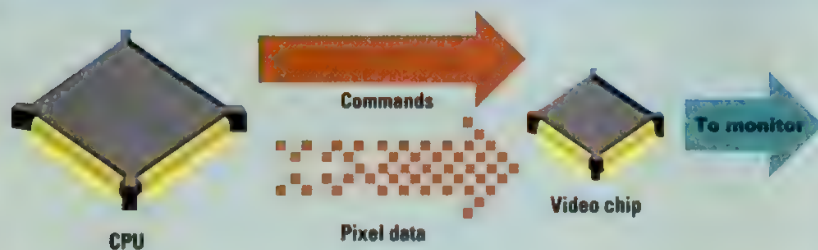
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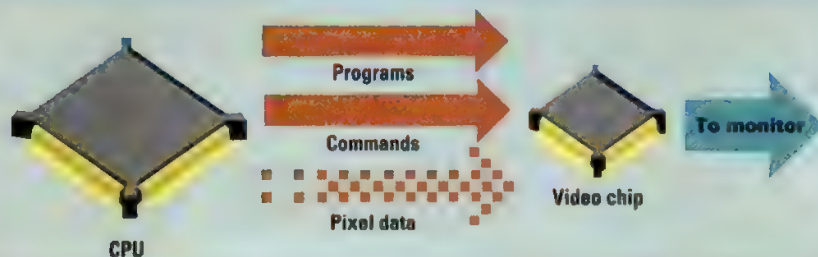
FRAME BUFFER



ACCELERATOR



COPROCESSOR



Unlike frame buffers (which accept only bitmapped image data), fixed-function accelerators and video coprocessors off-load calculations from the system's CPU; the lessened burden on the CPU, combined with the smaller data stream needed for the required instructions, results in improved performance. Coprocessors have an added advantage: They can also be programmed to process new functions.

turned in faster performances in these modes than did the ISA-based frame-buffer players. Frame-buffer designs—including Tseng's ET4000—were responsible for some of the lowest throughput on these tests, providing from 1.06 to 2.59 megapixels per second in 256-color VGA modes, and from 1.29 to 2.51 in Super VGA modes.

We found that coprocessed boards based on Texas Instruments' TI TMS34020 chip set can also produce fine performance on the 256-color, 640-by-480, and 800-by-600 Windows tests—sometimes even better than some of the accelerator cards. The catch is that only a few TMS34020-based boards include VGA on-board, and products based on

these coprocessors are generally costly, with prices typically ranging from \$1,000 to several thousand dollars.

The results indicating the difference between the Windows performance you can achieve on an EISA bus versus that available on an ISA bus were mixed. The only accelerator-based board pair in this category came from Compaq: the Compaq QVision 1024/E and the Compaq QVision 1024/I. Here, the throughput difference between EISA and ISA performance ranged from less than 10 percent for 640-by-480 mode at 256 colors (2.55 megapixels per second for the Compaq EISA version versus 2.38 for the ISA version) to a bit better than double the performance for the EISA product over

the ISA design in 800-by-600 mode with 256 colors (4.90 megapixels per second for EISA versus 2.34 for ISA).

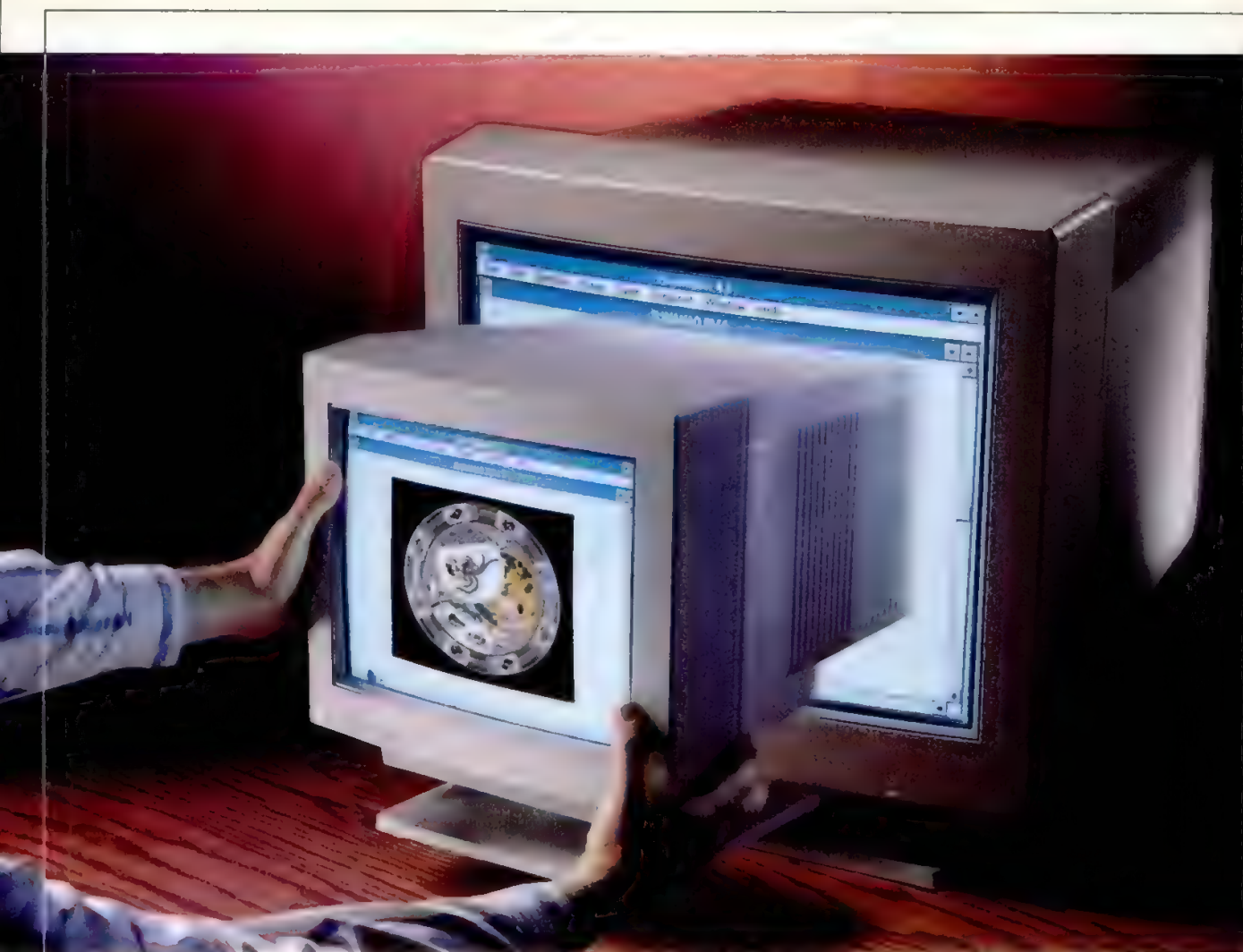
The results were less impressive in the frame-buffer category, with an EISA version of Orchid's ET4000-based ProDesigner/II's board proving not to be any faster than the fastest ET4000-based ISA

*Cards based on the Mach
32 accelerator show the
VL-Bus version to be
nearly three times as
fast as the ISA version of
the same card.*

scores in 640-by-480 mode with 256 colors (1.36 megapixels per second versus 1.54). The Orchid EISA version also had nearly 15 percent less throughput than the fastest ET4000 ISA board at 800-by-600 with 256 colors (1.30 megapixels per second versus 1.51). According to an Orchid representative, differences in performance are mostly due to lack of driver optimization for the EISA version.

The performance differences between a single accelerator chip on the ISA and VL-Bus are more dramatic. The cards based on the Mach 32 accelerator show the VL-Bus version to be nearly three times as fast as the ISA version of the same card (in the more powerful machine). The increase was consistent at both 640-by-480 and 800-by-600 resolutions at 256 colors (18.29 megapixels per second for the VL-Bus version versus 6.43 for the ISA version at the lower resolution, and 18.52 compared with 6.42 at the higher resolution). Across buses, the Mach 32 chip on the VL-Bus was the fastest performer of all chip types—including coprocessors—at both resolutions and 256 colors.

The upshot? If working in Windows at resolutions no greater than 800-by-600 and at color depths no larger than 256 makes sense for you, then an accelerator board will be the most cost-efficient and effective. And if it makes financial sense for you to move up from the ISA bus to the VL-Bus architecture at the same



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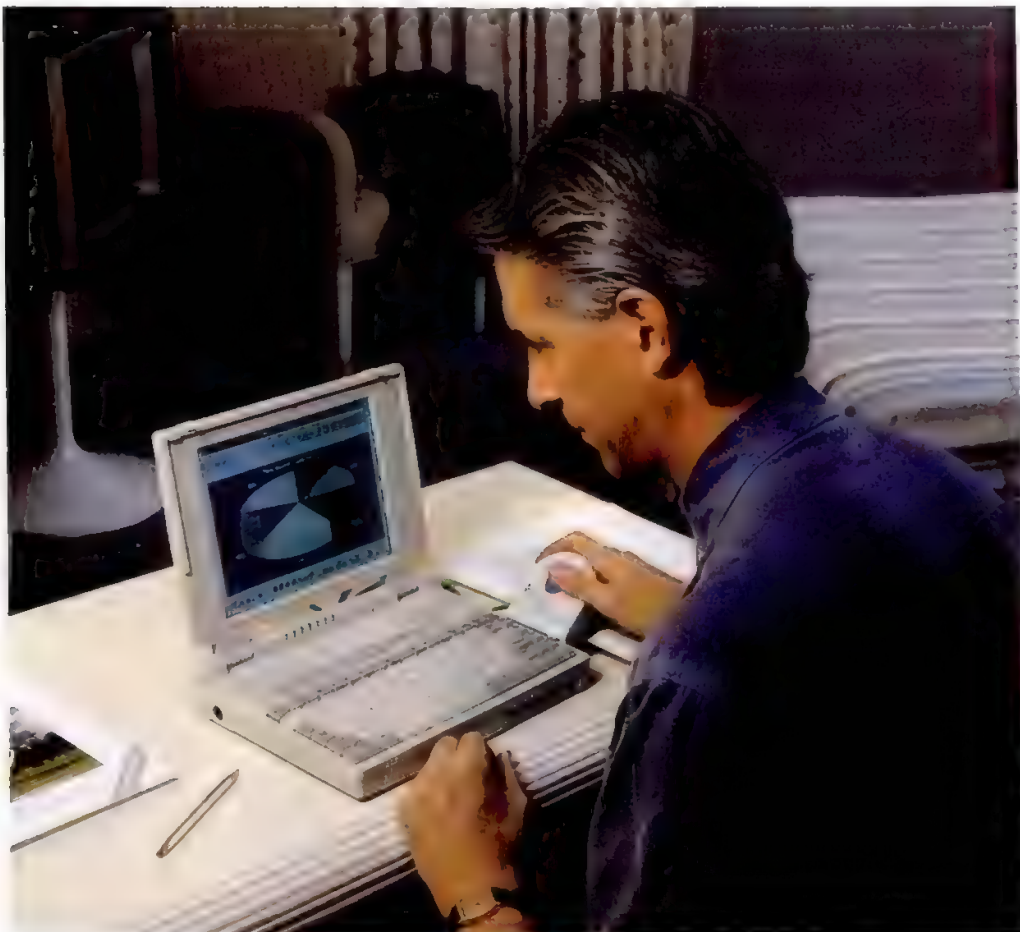
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- MS-DOS 5.0
- 14" SVGA color monitor with 1MB local bus video card
- Northgate 101-S keyboard

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- Two bus-master VESA local bus slots
- Six 32-bit EISA bus master slots
- 128K adaptive write-back cache; expands to 256K
- 4MB RAM; expands to 128MB
- 200MB hard drive
- 1.2MB or 1.44MB floppy drive
- MS-DOS 5.0
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- Northgate 101-S keyboard

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- 80486DX2/66 processor
- Upgradable to i486 processors and OverDrives; supports P24-T
- Two bus-master VESA local bus slots
- 64K cache; expands to 256K
- 4MB RAM; expands to 64MB
- 200MB hard drive
- 1.2MB or 1.44MB floppy drive
- MS-DOS 5.0
- 14" SVGA color monitor with 1MB local bus video card
- Northgate 101-S keyboard

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- 80486DX2/66 processor
- Upgradable to i486 processors and OverDrives; supports P24-T
- Six 32-bit EISA bus master slots
- 128K write-back cache expands to 256K
- 4MB RAM; expands to 64MB
- 200MB hard drive
- Jumbo 8-bay tower case
- 300 watt power supply; 450 watt also available
- 1.2MB or 1.44MB floppy drive
- MS-DOS 5.0
- 14" VGA monochrome monitor
- Northgate 101-S keyboard

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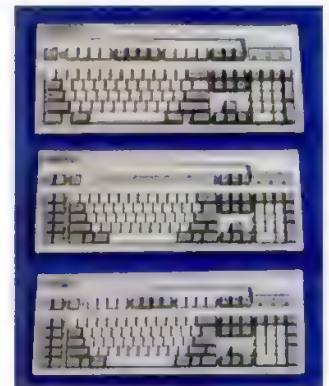
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- EISA bus master with 33MB burst mode transfers
- 16MB cache; expands 64MB
- 400MB base storage; expands to 10GB
- RAID levels 0, 1 and 5
- Hot-sparing and background data rebuild for zero downtime
- Three independent power supplies with redundancy
- 14" VGA monochrome monitor
- Northgate 101-S keyboard
- Novell certified device drivers and utilities for NetWare™ 3.11
- Vertical case
- Five year limited warranty

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- EISA bus master with 33MB burst mode transfers
- 16MB cache; expands to 64MB
- 400MB fault-tolerant storage
- RAID levels 0, 1 and 5
- i960-based RAID controller and cabling to connect the array to the server
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RAISING THE BAR

But perhaps you push Windows harder than that. Maybe you're a desktop publisher or a graphics artist who works heavily with illustration or image-editing programs. Odds are that you run Windows at resolutions of 1,024-by-768 or higher, and with 256, 32,000 (15-bit), 65,000 (16-bit), or even 16 million (24-bit "true-color") simultaneous colors. At lower resolutions (VGA or 800-by-600), fixed-function accelerators still have the edge in performance when working in deep color modes, with ATI's Mach 32 chip, S3's 801 chip, and C&T's Wingine/82C481 combination leading the way. The Mach 32 managed 5.69 megapixels per second in 800-by-600 at 32,000 colors and 6.09 in 640-by-480, 32,000-color mode. The S3 801 chip scored a good 5.46 megapixels per second at 24-bit 640-by-480 resolutions. The C&T pair was fastest, with 8.3 megapixels per second at 640-by-480 and 65,000 colors. The accelerators had little competition from the coprocessors we tested in these areas, since few of the coprocessors had 32K and 64K drivers at 640-by-480 and 800-by-600 resolutions.

Only one chip in this survey offered comparisons across bus designs at a mix of low resolution and high colors. The Orchid ProDesigner IIs/EISA with its Tseng ET4000 chip provided performance that was slower than that of the fastest ISA design, the ProDesigner IIs, at 640-by-480 with 15-bit color. The EISA-bus version turned in a score of 1.07 megapixels per second at 640-by-480 with 15-bit color, versus the ISA-bus version's 1.31. The same was true of its performance in 800-by-600 mode with 15-bit color, where the EISA version scored 1.03 versus the ISA version's 1.98.

Move into high gear with resolutions of 1,024-by-768 and beyond and a third breed of graphics chip becomes an important force: the graphics coprocessor. Graphics coprocessors are able to serve as CPUs in their own right, but they are instead dedicated to the task of calculating display image data.

The big difference between graphics coprocessors and fixed-function accelerators is the fact that coprocessors can be

programmed. Just as you can write a program for an 80486 to execute, you can create programs for graphics coprocessors to run. If your software needs a change, all it takes is a new driver to reprogram the coprocessor to handle the added functions. Obviously, the quality of the driver you write will have a major impact on the design's performance. As with a fixed-function accelerator, the video image information can be condensed into a sequence of commands rather than bit images. This requires less CPU time, and the shorter data stream gets to the card more quickly. Coprocessors can also handle much larger amounts of display memory than VGA-compatible accelerators, which is essential if you're going to be editing large true-color images.

340x0s AND CO.

The most well-known family of graphics coprocessors is made by Texas Instruments. The TI TMS34010 was the first in the series; it is a 16-bit processor with a 16-bit data path. The TI TMS34020 is a 32-bit processor with a full 32-bit data path, so it is able to accept more data at one shot than the TMS34010. Not surprisingly, our tests show that the TMS34020, which can also run at higher frequencies, generally outperforms the TMS34010.

In addition to boards with TMS34010 and TMS34020 chips, we also tested the Microfield Graphics X-8 board (\$1,995 with 2MB of VRAM and \$2,145 with the 2MB DRAM upgrade). The X-8 board builds a proprietary programmable engine using a bit-slice processor, the Cypress 7C9101, along with custom BLT ASICs, which share a 64-bit-wide data path. This setup is designed to be especially fast at moving large blocks of data, an ability that is required for scrolling and panning operations. The X-8 board is also optimized for data transfers across the ISA bus; Microfield Graphics claims that the board can achieve a maximum transfer rate of 5MB per second.

As we noted previously, most of the TI-based boards, as well as the Microfield

product, don't have any on-board VGA circuitry, which is why you'll see little in the way of DOS VGA results for coprocessors. Unlike most fixed-function accelerators, many coprocessors need a separate VGA chip to handle VGA functions (which you need, for example, to see the DOS prompt when you boot up your computer).

The big difference between graphics coprocessors and fixed-function accelerators is the fact that coprocessors can be programmed.

Many of these coprocessors let you attach them to the VGA pass-through connector on a separate VGA adapter; the pass-through connector often appears as an edge connector on the top of the VGA card, though many designs now save board space by using a dual-row pin connector

similar to those used on hard disk controllers. In the group we looked at for this technology survey, almost all the coprocessors that didn't have on-board VGA provided a VGA pass-through connection. The single exception was the Microfield X-8, which uses the dual-row pin connector to establish VGA connections to its proprietary daughtercard.

Remember, though, that if a coprocessed adapter requires a separate VGA controller, this will both consume one more expansion slot in your system and increase the total cost of your graphics setup. But if you're already getting great DOS performance out of your current card, and you don't mind spending the money, adding a TI-based pass-through card to accelerate Windows may be the way to give your system a boost without sacrificing DOS performance.

Of the TMS34010 and TMS34020 boards we used for testing for this story, only three came with VGA on-board or used a proprietary daughtercard (the latter approach also will take up an additional slot): the \$699 TMS34010-based Hercules Graphics Station, Card +2; the \$995 TMS34020-based National Design AT1000; and the \$1,995 TMS34020-based Opta MonaLisa board. The other TI-series boards we tested did not come with on-board VGA: These include the \$2,295 TMS34020-based #9 GXiTC from Number Nine, the TMS34020-based

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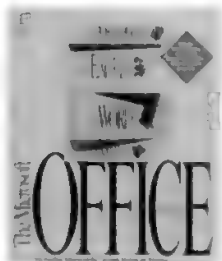


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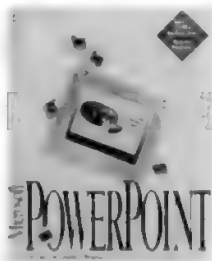
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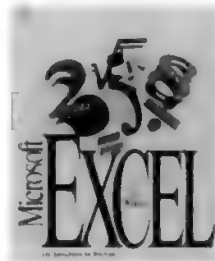
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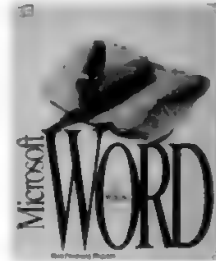
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CIRCLE 203 ON READER SERVICE CARD

For performance in DOS applications, frame buffers still lead the field, as our DOS video scores demonstrate. Accelerators have the overall edge in Windows performance, and the TI TMS34020 coprocessor is still the fastest under AutoCAD. Yet some accelerators can match the AutoCAD performance of its less powerful sibling, the TI TMS34010.

HOW WE TESTED

We have focused our technology survey in this story on the performance of chip types within particular classes (frame buffers, accelerators, and coprocessors). Whenever possible, we tested several boards using the same chip, and we publish the minimum and maximum scores that each chip achieved using a particular bus. In cases where no chips in a given class supported a specific resolution and color depth, dashes appear in the tables. Following the bus and chip comparisons, we publish test results for the Windows accelerator boards discussed in "Accelerators: Bringing Windows Up to Warp Speed."

At PC Magazine Labs, we tested the EISA and ISA graphics boards in a Compaq Deskpro 386/25M equipped with 8MB of RAM, a 310MB ESDI hard disk, a 25-MHz 80387 math coprocessor, and Compaq DOS 5.0. In almost all cases, we removed the Compaq's standard VGA card before running our tests (the only exceptions were for boards that did not have on-board VGA, like members of the TI 340x0 series).

We tested the VL-Bus graphics boards on a Micronics PC equipped with a 486/33 VL-Bus motherboard and 8MB of RAM, a 210MB IDE hard disk, MS-DOS 5.0, Microsoft Windows 3.1, and AutoCAD, Release 11. We could not test the VL-Bus add-in cards on a 386/25 machine because VL-Bus motherboards typically start at the 486/33 level.

We ran three kinds of tests on the products: the DOS video test routines from our new Hardware Benchmark Tests, Release 7.0; the Graphics Winmark routines from our new Windows Benchmark Tests (Winbench), Release 3.1; and a set of AutoCAD performance tests.

TO CACHE OR NOT TO CACHE

Bitmap caching is a new and controversial feature of Windows accelerator cards that can make a huge difference in test performance. It works like this: The Windows software driver manages unused off-screen memory in the graphics subsystem, storing copies of bitmaps there and reusing them whenever possible. Bitmap caching works because the graphics accelerator hardware can accomplish screen-to-screen BitBlt (bit-block transfers) much faster than memory-to-screen BitBlt.

The controversy arises because caching can be used to mask an inadequacy in transferring data from PC memory to graphics memory with memory-to-screen BitBlt. In the near future, any application that presents large bitmaps on-screen—for example, by displaying a film clip at 30 frames per second or by panning across a geographical map—may reveal bitmap caching to be a mere cover-up for inferior data bandwidth in the graphics hardware.

Another drawback of bitmap caching is that it chews up precious CPU instruction cycles while figuring out whether a bitmap has already been cached and can be reused. CPU cycles are less precious on faster 486 machines (33-MHz and above), so bitmap caching is likely to yield much speedier graphics on this class of PC. By contrast, bitmap caching is likely to slow down the graphics on a low-end 386 clocking at 16 MHz or 20 MHz.

A well-designed graphics-card-and-driver combo uses as much off-screen graphics memory as possible for bitmap caching. If you are running a graphics card with 1MB of memory and a Windows driver at 800-by-600 resolution with 256 colors, just over half a mega-

byte is available for caching. But if you are running the same card with a Windows driver at 1,152-by-900 with 256 colors, it has less than 12K of memory available for off-screen caching, an amount hardly worth bothering to use.

The **DOS video** score is the weighted harmonic mean of the results of several direct-to-screen text-write and graphics-write tests. Because our test routines do not use drivers or invite software overhead in exercising the VGA circuitry, they accurately represent each video chip's VGA performance.

The **Graphics Winmark** score is a weighted harmonic mean based on 12 Windows graphics and text functions derived from extensive profiling of popular Windows applications. It is measured in megapixels per second (a megapixel is 1,048,576 pixels). For a detailed explanation of the new Winbench tests, see Lab Notes, *PC Magazine*, December 8, 1992.

The **AutoCAD** performance test, developed by Chris Delucci of the San Diego AutoCAD Users Group, evaluates the quality of the ADI or display list processor driver, as well as the vector-generation capabilities of each chip. It measures the total time required to execute a series of AutoCAD commands.

For the Windows accelerators, we report separate scores for four tasks from the AutoCAD test: repeated Zooms on fixed text; Zooms on an area of random vectors (polygons, polylines, radial patterns, and line entities); and Zooms to Center and Redraws on a 3-D model (approximately 500K).

DOS VIDEO (EISA BUS)

Thousands of operations per second	0	2,000	4,000	6,000	
Compaq 128084					5,946.75
Tseng ET4000					6,014.88
	WORST			BEST	

AUTOCAD (EISA BUS)

Seconds	0	200	400	600	800	
Compaq 128084						374.12
Tseng ET4000						968.38
	BEST				WORST	

GRAPHICS WINMARK (EISA BUS)

Megapixels per second	640x480					800x600					1,024x768		
	16 colors	256 colors	32,768 colors	65,536 colors	24-bit color	16 colors	256 colors	32,768 colors	65,536 colors	24-bit color	16 colors	256 colors	24-bit color
Compaq 128084	—	2.55	—	—	—	—	4.90	—	—	—	—	2.44	—
Tseng ET4000	—	1.36	1.07	—	—	—	1.29	1.03	—	—	1.72	1.38	—

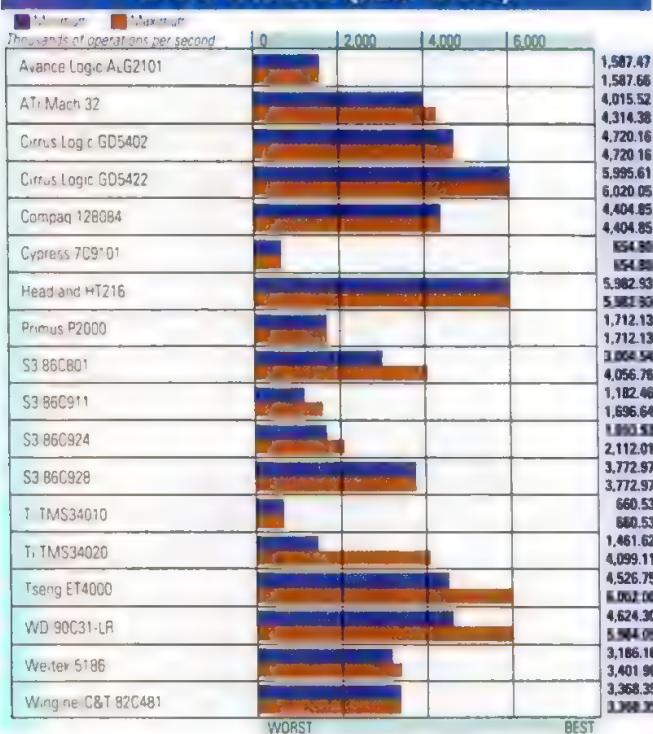
A dash (—) indicates that the board we tested using this chip did not come with drivers for this mode. Higher scores represent better performance.



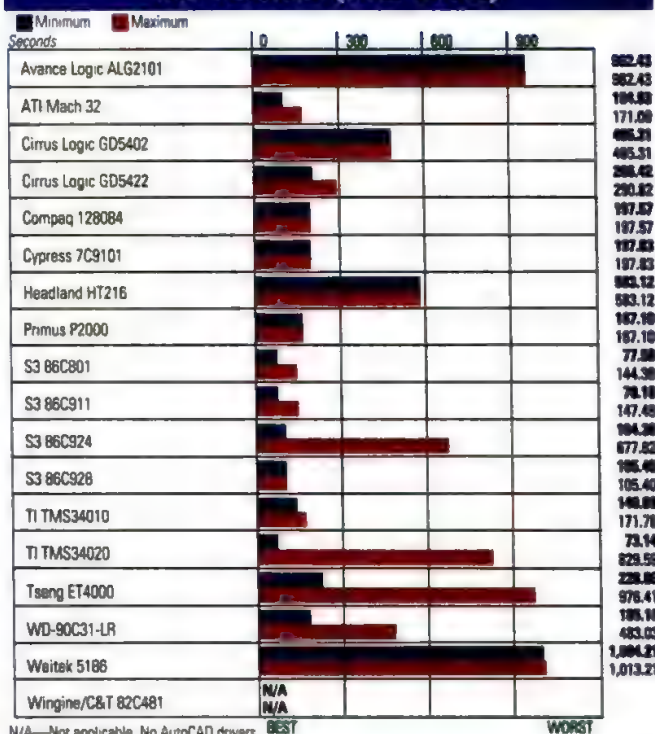
Benchmark Tests: Video Technology

CONTINUES

DOS VIDEO (ISA BUS)



AUTOCAD (ISA BUS)

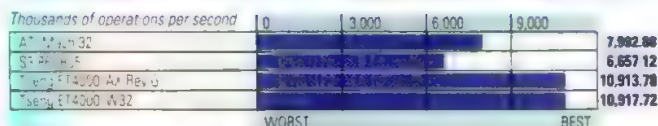


GRAPHICS WINMARK (ISA BUS)

	640x480					800x600					1,024x768				
	16 colors	256 colors	32,768 colors	65,536 colors	24-bit color	16 colors	256 colors	32,768 colors	65,536 colors	24-bit color	16 colors	256 colors	32,768 colors	65,536 colors	24-bit color
	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max
Avance Logic ALG2101	—	—	2.04 2.05	—	—	—	—	1.94 1.94	—	—	0.68 0.68	—	—	—	—
ATI Mach 32	6.45 6.45	6.43 6.37	6.09 6.09	—	—	6.48 6.48	6.39 6.42	5.69 5.69	—	—	6.45 6.45	6.29 6.45	—	—	—
Cirrus Logic GD5402	—	2.29 2.29	—	—	—	1.72 1.72	1.98 1.98	—	—	—	1.68 1.68	—	—	—	—
Cirrus Logic GD5422	2.06 2.06	2.06 2.59	—	—	0.64 0.72	2.06 2.06	2.51 2.51	—	1.35 1.37	—	1.74 2.04	2.24 2.59	—	—	—
Compaq 128084	—	2.38 2.38	—	—	—	—	2.34 2.34	—	—	—	—	2.35 2.35	—	—	—
Cypress 7C9101	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Headland HT216	—	2.13 2.13	—	—	—	—	2.11 2.11	1.52 1.52	—	—	—	1.89 1.89	—	—	—
Primus P2000	1.94 1.94	1.31 1.31	—	—	0.36 0.36	2.12 2.12	1.26 1.26	—	0.42 0.42	—	1.90 1.90	1.19 1.19	—	—	—
S3 86C801	—	5.18 5.79	—	2.70 2.70	5.46 5.46	0.20 0.60	5.26 5.70	—	—	—	1.44 1.44	5.27 7.11	—	—	—
S3 86C911	—	3.33 3.53	1.61 1.65	—	1.81 1.81	3.63 3.69	3.29 3.55	—	—	1.81 1.81	3.69 3.75	3.32 3.59	—	—	—
S3 86C924	2.04 2.04	3.51 4.59	1.32 2.23	1.66 1.66	0.23 0.23	3.68 4.23	3.47 4.61	—	—	—	3.71 4.26	3.51 4.61	—	—	—
S3 86C928	—	5.59 5.59	2.75 2.75	2.75 2.75	—	5.44 5.44	5.60 5.60	—	—	—	5.42 5.42	5.59 5.59	—	—	—
Ti TMS34010	—	2.04 2.06	1.11 1.18	—	—	—	1.79 1.84	—	—	—	—	2.08 2.11	—	—	—
Ti TMS34020	1.42 7.69	1.73 7.03	—	—	0.22 3.12	1.56 9.02	3.40 7.11	—	—	1.44 3.16	1.42 8.94	5.26 6.91	1.56 3.16	—	—
Tseng ET4000	2.45 2.45	1.06 1.54	1.31 1.31	—	0.74 0.74	1.05 1.68	1.31 1.51	0.96 1.98	—	—	1.39 1.72	1.36 1.55	—	—	—
WD-90C31-LR	3.06 3.10	2.37 5.12	0.80 0.80	—	0.95 0.95	2.97 3.08	2.60 5.06	0.55 0.74	—	—	2.71 2.83	2.58 4.93	—	—	—
Weitek 5186	2.92 2.92	1.41 1.63	0.95 0.95	—	—	2.19 2.27	2.11 2.11	0.93 0.93	—	—	2.33 2.69	1.63 1.63	—	—	—
Wingine/C&T 82C481	—	8.95 8.59	—	8.30 8.30	—	—	8.94 8.94	—	—	—	—	9.44 9.44	—	—	—

A dash (—) indicates that the boards we tested using this chip did not come with drivers for this mode. Higher scores represent better performance.

DOS VIDEO (VL-BUS)



AUTOCAD (VL-BUS)



GRAPHICS WINMARK (VL-BUS)

	640x480					800x600					1,024x768				
	16 colors	256 colors	32,768 colors	65,536 colors	24-bit color	16 colors	256 colors	32,768 colors	65,536 colors	24-bit color	16 colors	256 colors	32,768 colors	65,536 colors	24-bit color
	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max	Min Max
ATI Mach 32	18.35	18.29	—	13.21	—	18.53	18.52	—	13.18	—	—	18.39	13.00	—	—
S3 86C805	—	—	—	—	—	—	—	—	—	—	—	2.96	—	—	—
Tseng ET4000/AX Rev G	—	3.35	—	—	—	—	3.34	—	—	—	—	3.23	—	—	—
Tseng ET4000/W32	—	5.83	—	—	—	—	8.33	—	—	—	—	5.71	—	—	—

A dash (—) indicates that the board we tested using this chip did not come with drivers for this mode. Higher scores represent better performance.



Benchmark Tests: Graphics Adapters

CONTINUES

As a rule, boards that used a given processor tended to have similar scores. The Pycon WinJet Edge, with C&T's 82C481 and Wingine chips, edged out the others on Winmark performance. Close behind were the two ATI boards, which use the ATI Mach 32 chip; these were followed closely by the S3 801-based boards (the NDI Volante Warp10 and the STB PowerGraph X-24). Among boards using a given chip, the vendor's optimization techniques for its Windows drivers contribute most to performance differences.

DOS VIDEO

Thousands of operations per second	0	2,000	4,000	
Actix GraphicsEngine 1280				2,111.48
Artist Graphics WinSprint 100+				1,693.93
ATI Graphics Ultra Plus				4,314.38
ATI Graphics Ultra Pro				4,015.52
Cache Computers Lynx VGA Model 336	Fail			
Cardina VGA 900				1,696.64
Celerite Galaxy 2000				1,712.13
Compaq QVision 1024/I				4,404.85
Diamond SpeedSTAR 24X				5,984.08
Diamond Flower VG-8000WH				4,624.30
Edge V24 BitBlaster	Fail			
Focus 2 the Max VGA GUI 6000	Fail			
Hercules Graphics Station Gold 16+2	N/A*			
Hercules Graphics Station Gold 24+2	N/A*			
Hercules Graphics Station GB1024+2				960.53
iDcomm Michaelangelo VRAM				1,611.54
Kingston View Rx				3,186.16
Matrox HiPer-VGA				1,349.13
Matrox Impression 1024				1,349.36
Metheus Premier 1280NI				2,112.81
Mylex GLI911				1,348.89
NDI Volante AT600 Plus				1,349.92
NDI Volante AT1000				4,999.11
NDI Volante Warp10				3,004.54
Orchid Fahrenheit 1280*				1,894.89
Portacom Eclipse II				1,875.19
Presenta Graphics Accelerator VGA				1,341.60
Prism Accelerator X-VGA				1,587.47
Pycon WinJet Edge				3,368.35
Quickpath Cyclone XGi				1,933.97
Sigma Designs Legend GX				1,708.85
STB PowerGraph X-24				4,096.73
STB Wind/X HC GUI Accelerator				1,182.46
Tangram TANXcell-GUI				1,587.66
Video Seven WIN VGA				5,982.93
VidTech WinMax				3,401.90
WD Paradise Accelerator Card				5,944.97
	WORST		BEST	

Fail—Unable to complete the test
N/A*—Not applicable. No on-board VGA

GRAPHICS WINMARK

(800x600, 256 colors)	0	2	4	6	8	
Megapixels per second						
Actix GraphicsEngine 1280						3.57
Artist Graphics WinSprint 100+						4.61
ATI Graphics Ultra Plus						6.38
ATI Graphics Ultra Pro						6.42
Cache Computers Lynx VGA Model 336						4.10
Cardina VGA 900						3.95
Celerite Galaxy 2000						1.26
Compaq QVision 1024 I						2.34
Diamond SpeedSTAR 24X						5.06
Diamond Flower VG-8000WH						2.60
Edge V24 BitBlaster						3.55
Focus 2 the Max VGA GUI 6000						3.57
Hercules Graphics Station Gold 16+2						1.79
Hercules Graphics Station Gold 24+2						1.79
Hercules Graphics Station GB1024+2						1.84
iDcomm Michaelangelo VRAM						3.51
Kingston View Rx	N/A**					
Matrox HiPer-VGA						3.29
Matrox Impression 1024						3.32
Metheus Premier 1280NI						3.53
Mylex GLI911						3.41
NDI Volante AT600 Plus						3.54
NDI Volante AT1000						5.23
NDI Volante Warp10						5.70
Orchid Fahrenheit 1280*						3.57
Portacom Eclipse II						3.51
Presenta Graphics Accelerator VGA						3.54
Prism Accelerator X-VGA						1.94
Pycon WinJet Edge						8.94
Quickpath Cyclone XGi	N/A**					
Sigma Designs Legend GX						3.56
STB PowerGraph X-24						5.59
STB Wind/X HC GUI Accelerator						3.47
Tangram TANXcell-GUI						1.94
Video Seven WIN VGA						2.11
VidTech WinMax						2.11
WD Paradise Accelerator Card						2.75
	WORST				BEST	

N/A**—Not applicable. No drivers for this mode

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Benchmark Tests: Graphics Adapters

ENDS

AUTOCAD (TEXT ZOOM)

Seconds	0	100	200	300	
Actix GraphicsEngine 1280					44.77
Artist Graphics WinSprint 100+					26.26
ATI Graphics Ultra Plus					30.54
ATI Graphics Ultra Pro					18.57
Cache Computers Lynx VGA Model 336					45.29
Cardinal VGA 900					44.71
Celerite Galaxy 2000					23.39
Compaq QVision 1024/i					63.94
Diamond SpeedSTAR 24X					46.80
Diamond Flower VG-8000WH					102.27
Edge V24 BitBlaster					44.71
Focus 2 the Max VGA GUI 6000					44.71
Hercules Graphics Station Gold 16+2					30.39
Hercules Graphics Station Gold 24+2					30.39
Hercules Graphics Station GB1024+2					38.28
IDcomm Michaelangelo VRAM	Fail				
Kingston View Rx					330.65
Matrox HiPer-VGA	N/A***				
Matrox Impression 1024					22.57
Matheus Premier 1280NI					37.62
Mylex GL1911					45.21
NDI Volante AT600 Plus					20.10
NDI Volante AT1000					18.04
NDI Volante Warp10					19.99
Orchid Fahrenheit 1280*					44.71
Portacom Eclipse II					192.68
Presenta Graphics Accelerator VGA					44.77
Prism Accelerator X-VGA	Fail				
Pycon WinJet Edge	N/A***				
Quickpath Cyclone XGi					193.77
Sigma Designs Legend GX	Fail				
STB PowerGraph X-24	Fail				
STB Wind/X HC GUI Accelerator	Fail				
Tangram TANXcell-GUI					311.49
Video Seven WIN VGA					146.49
VidTech WinMax					332.63
WD Paradise Accelerator Card					95.02

Fail—Unable to complete the test

BEST

WORST

N/A***—Not applicable. No AutoCAD drivers

AUTOCAD (3-D MODEL ZOOM)

Seconds	0	50	100	150	200	
Actix GraphicsEngine 1280						31.16
Artist Graphics WinSprint 100+						21.81
ATI Graphics Ultra Plus						53.11
ATI Graphics Ultra Pro						19.94
Cache Computers Lynx VGA Model 336						31.47
Cardinal VGA 900						30.86
Celerite Galaxy 2000						42.18
Compaq QVision 1024/i						36.74
Diamond SpeedSTAR 24X						48.21
Diamond Flower VG-8000WH						79.70
Edge V24 BitBlaster						30.90
Focus 2 the Max VGA GUI 6000						31.03
Hercules Graphics Station Gold 16+2						2.00
Hercules Graphics Station Gold 24+2						2.06
Hercules Graphics Station GB1024+2						23.50
IDcomm Michaelangelo VRAM	Fail					
Kingston View Rx						221.13
Matrox HiPer-VGA	N/A***					
Matrox Impression 1024						22.47
Matheus Premier 1280NI						30.76
Mylex GL1911						31.80
NDI Volante AT600 Plus						1.48
NDI Volante AT1000						1.76
NDI Volante Warp10						1.81
Orchid Fahrenheit 1280*						30.98
Portacom Eclipse II						203.72
Presenta Graphics Accelerator VGA						31.04
Prism Accelerator X-VGA	Fail					
Pycon WinJet Edge	N/A***					
Quickpath Cyclone XGi						203.89
Sigma Designs Legend GX	Fail					
STB PowerGraph X-24	Fail					
STB Wind/X HC GUI Accelerator	Fail					
Tangram TANXcell-GUI						211.68
Video Seven WIN VGA						174.44
VidTech WinMax						222.81
WD Paradise Accelerator Card						63.44

Fail—Unable to complete the test

BEST

WORST

N/A***—Not applicable. No AutoCAD drivers

AUTOCAD (RANDOM VECTOR ZOOM)

Seconds	0	40	80	120	160	
Actix GraphicsEngine 1280						12.25
Artist Graphics WinSprint 100+						4.39
ATI Graphics Ultra Plus						8.35
ATI Graphics Ultra Pro						1.98
Cache Computers Lynx VGA Model 336						12.41
Cardinal VGA 900						12.20
Celerite Galaxy 2000						7.09
Compaq QVision 1024/i						27.00
Diamond SpeedSTAR 24X						7.30
Diamond Flower VG-8000WH						51.00
Edge V24 BitBlaster						12.20
Focus 2 the Max VGA GUI 6000						12.20
Hercules Graphics Station Gold 16+2						4.78
Hercules Graphics Station Gold 24+2						4.83
Hercules Graphics Station GB1024+2						4.89
IDcomm Michaelangelo VRAM	Fail					
Kingston View Rx						174.17
Matrox HiPer-VGA	N/A***					
Matrox Impression 1024						2.30
Matheus Premier 1280NI						2.63
Mylex GL1911						12.41
NDI Volante AT600 Plus						1.90
NDI Volante AT1000						2.14
NDI Volante Warp10						2.20
Orchid Fahrenheit 1280*						12.19
Portacom Eclipse II						39.87
Presenta Graphics Accelerator VGA						12.30
Prism Accelerator X-VGA	Fail					
Pycon WinJet Edge	N/A***					
Quickpath Cyclone XGi						39.76
Sigma Designs Legend GX	Fail					
STB PowerGraph X-24	Fail					
STB Wind/X HC GUI Accelerator	Fail					
Tangram TANXcell-GUI						177.03
Video Seven WIN VGA						39.93
VidTech WinMax						174.22
WD Paradise Accelerator Card						46.03

Fail—Unable to complete the test

BEST

WORST

N/A***—Not applicable. No AutoCAD drivers

AUTOCAD (REDRAW)

Seconds	0	10	20	
Actix GraphicsEngine 1280				4.39
Artist Graphics WinSprint 100+				2.80
ATI Graphics Ultra Plus				5.54
ATI Graphics Ultra Pro				2.91
Cache Computers Lynx VGA Model 336				4.45
Cardinal VGA 900				4.39
Celerite Galaxy 2000				5.61
Compaq QVision 1024/i				3.74
Diamond SpeedSTAR 24X				4.94
Diamond Flower VG-8000WH				8.02
Edge V24 BitBlaster				4.39
Focus 2 the Max VGA GUI 6000				4.40
Hercules Graphics Station Gold 16+2				1.65
Hercules Graphics Station Gold 24+2				1.70
Hercules Graphics Station GB1024+2				1.65
IDcomm Michaelangelo VRAM	Fail			
Kingston View Rx				28.40
Matrox HiPer-VGA	N/A***			
Matrox Impression 1024				3.46
Matheus Premier 1280NI				4.72
Mylex GL1911				4.45
NDI Volante AT600 Plus				3.03
NDI Volante AT1000				3.19
NDI Volante Warp10				3.19
Orchid Fahrenheit 1280*				4.34
Portacom Eclipse II				27.00
Presenta Graphics Accelerator VGA				4.45
Prism Accelerator X-VGA	Fail			
Pycon WinJet Edge	N/A***			
Quickpath Cyclone XGi				27.41
Sigma Designs Legend GX	Fail			
STB PowerGraph X-24	Fail			
STB Wind/X HC GUI Accelerator	Fail			
Tangram TANXcell-GUI				25.38
Video Seven WIN VGA				21.81
VidTech WinMax				28.67
WD Paradise Accelerator Card				6.48

Fail—Unable to complete the test

BEST

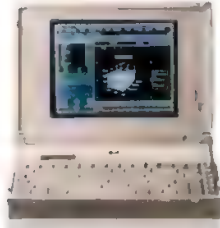
WORST

N/A***—Not applicable. No AutoCAD drivers

First SL notebook.



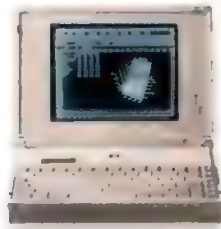
First Microsoft peer-to-peer notebook.



First upgradable-to-color notebook.



First notebook pre-loaded with
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comes with built-in networking with Ethernet-compatible, high-speed communication pipes for LAN connectivity. Only

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no extras.**



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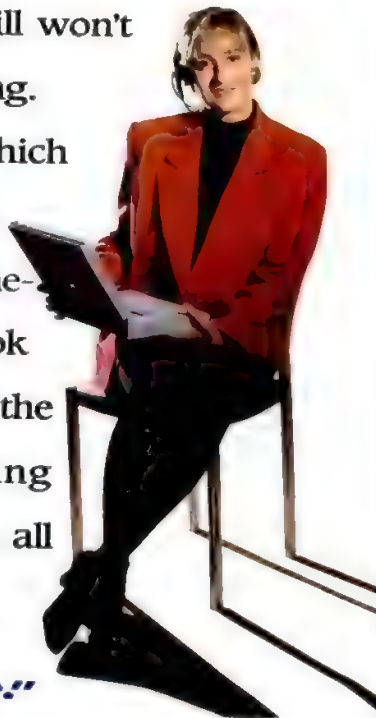
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could be the first to pre-install Microsoft Windows for Workgroups. Only Z•NOTE exclusively uses Intel 386SL microprocessors. The Z•NOTE has an active matrix color display. The Z•NOTE comes with MS-DOS and Microsoft Windows fully loaded and ready to run, right out of the box.

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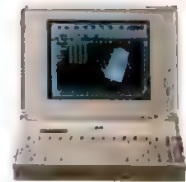


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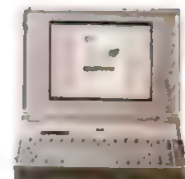
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- Logitech® TrackMan® Portable mouse
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- 3.5" 1.44MB floppy disk drive
- 8.5" x 11.9" x 1.9" only 5.9 pounds
- Rapid-charge nickel metal-hydrate battery for up to 4 hours* continuous use or up to 10 hours* under Rest/Resume condition
- **Pre-installed network client software for Novell® NetWare®, Microsoft LAN Manager®, Banyan® VINES®**
- **Ethernet-compatible high-speed communication port for LAN connectivity**
- 82-key keyboard with 12 full-size function keys

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Z•NOTE 325Lc

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- 4MB RAM, user expandable to 12MB
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*Battery life depends on application used, power management features selected and peripherals attached

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Chances are, what those new lightweight subnotebooks you're considering are light on are features and functionality. Especially if you use Microsoft Windows. So it's a

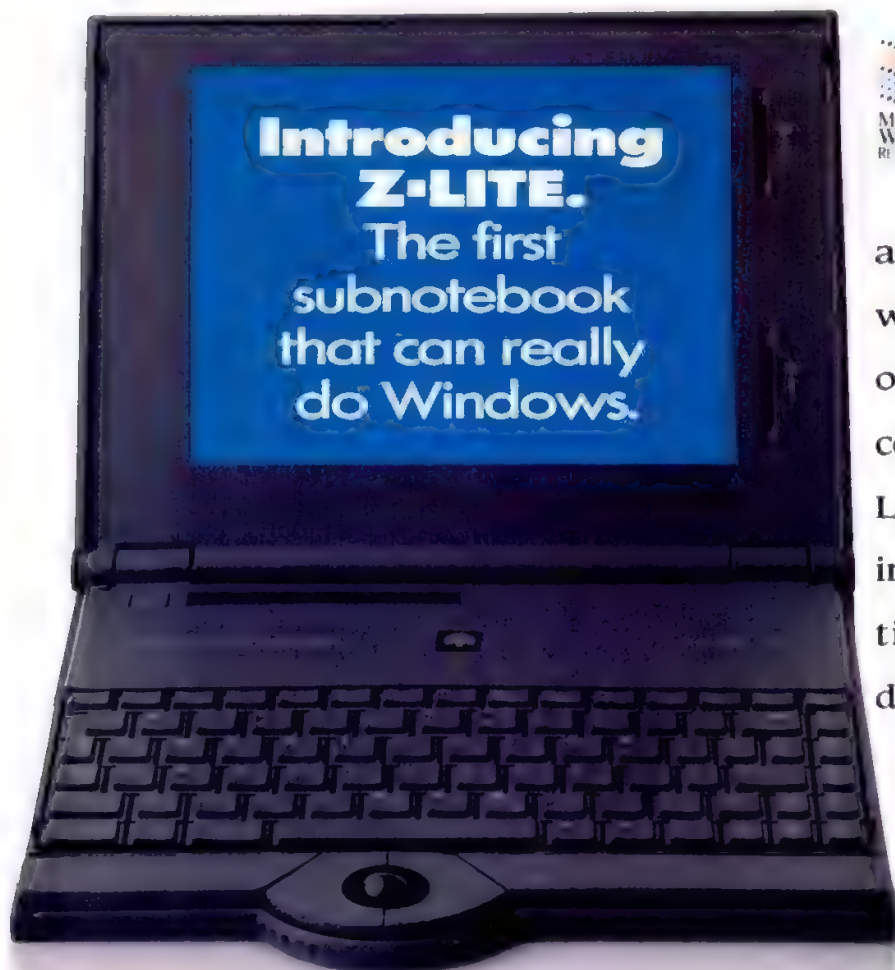


good thing you've discovered new Z•LITE 320L. Because no lightweight does Microsoft Windows like Z•LITE. Z•LITE combines every heavyweight feature you need to run Microsoft Windows in an ultra-lightweight PC. Like the power of Intel 386SL technology—instead of the no-name chip others foist off on you.

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PCMCIA
TYPE II SLOTS.**

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with backlit
VGA.**



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**The first
3.3V
386SL
subnotebook.**

**JANUARY
1993**

So what more can we do for you?

Z•LITE 320L gives you flexibility and options. There's two PCMCIA card slots for accommodating high speed data/fax modems, wireless communications and more.

And to make your life easier, we've combined the external floppy disk drive and AC adapter/charger in an all-in-one design.

Z•LITE 320L is the best of Zenith Data Systems technology, with an unbeatable Z•DIRECT

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Margie Silha,
Zenith Data
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Z•LITE™ 320L

"Full featured subnotebook"

- Intel 20 MHz i386SL (3.3V)
- 2MB RAM user expandable to 6MB
- 60MB hard disk drive
- MS-DOS 5.0 pre-installed
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- Optional LITEPOINT™ two-button detachable pointing device
- 8.5" VGA backlit black-on-white display with 64 grey scales
- Two PCMCIA type II slots
- NiCad battery pack for up to 3-hours* continuous or up to 6-hours* charge
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- One internal modem socket
- NiCad battery pack for up to 3 hours* battery life
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big names:
Intel, Conner
and Jeffrey Crouch.**

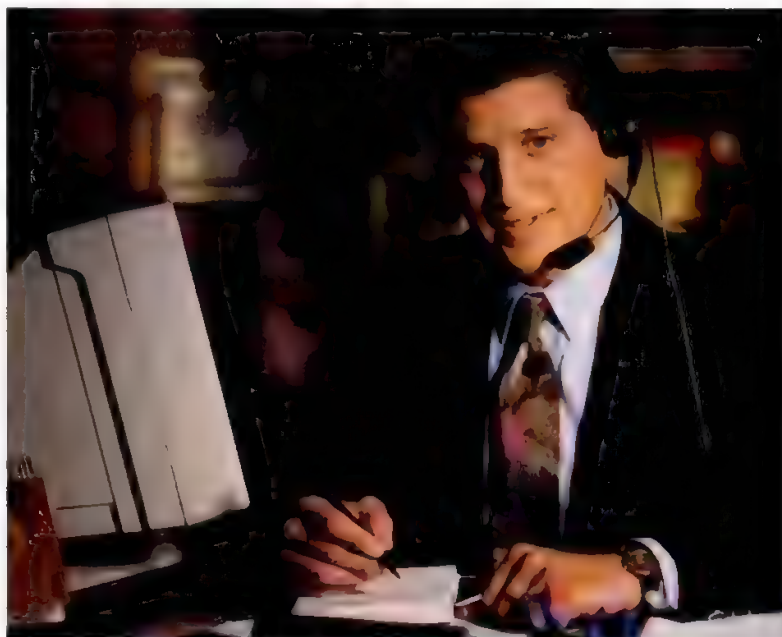
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- Intel 33 MHz i486DX
- 4MB RAM user expandable to 40MB
- 170MB hard disk drive with MS-DOS 5.0 and Microsoft Windows 3.1 pre-installed
- VGA color monitor, 256 colors
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- 5 open 16-bit ISA slots
- One 5.25" accessible drive bay
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\$1979



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- Intel 66 MHz i486DX (upgradable)
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- Z•VISION™ 14" VGA color monitor
- Mouse and mouse pad
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Over \$2,200 value based on manufacturer's suggested retail prices†



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- Z•VISION 14" SuperVGA color monitor
- Microsoft Mouse and mouse pad
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ZENITH DATA SYSTEMS

A Bull Company

Thinking Ahead.

Hercules Chrome (which ranges in price from \$1,295 to \$2,595, depending on configuration), the \$579 TMS34010-based Hercules Graphics Station Gold 16+2, the \$679 Hercules Graphics Station Gold 24+2, and the \$1,295 Matrox Impression S (which couples a TMS34020 chip with Matrox's proprietary supporting logic).

Although TMS34010 boards have come down in price in the past year, they are still generally more expensive than most accelerator offerings (though the Beaver TIGA-10, which we missed including in this review, is a remarkably economical TMS34010-based buy at \$350). An informal survey of vendors in this market, whose products we didn't test, puts the list price for most of these boards in the \$600 to \$1,200 range. Add this to another \$70 or so for a frame-buffer card to provide VGA support to many of them.

At the high-resolution or high-color end, where you may be willing to pay higher prices for maximum performance, there are indications that the TMS34010-based boards don't have much to offer over their cheaper, accelerated competitors. The results we saw for 1,024-by-768 resolutions and 256 colors (the only drivers for 1,024-by-768 modes that the TMS34010 ISA-based boards we evaluated supplied) topped out at 2.11 megapixels per second. At the same resolution and color depth, ISA-based accelerator boards averaged results in the range of 3 or 4 megapixels per second. And the more powerful accelerators—such as boards based on ATI's Mach 32 chip, C&T's Wingine/82C481 combination, and the S3 801 chip—racked up scores ranging from 5.27 to 9.44. With lower prices and better performance, it's not surprising that accelerators are squeezing the TMS34010-based boards at this end of the market.

On the other hand, the TMS34020-based coprocessors provided a better showing than the TMS34010-based boards (though the TMS34020s didn't always have the best scores on our tests) as you reach the upper limits of current Windows display modes. ISA boards using the TMS34020 reeled in a high score of 8.94 megapixels per second in 16-color 1,024-by-768 mode (compared with the best ISA-based accelerator's score of 6.45). In 256-color 1024-by-768 mode, the

TMS34020-based leader scored 6.91 (a little slower than the 9.44 of the leading ISA-based accelerator). The only ISA-bus boards that supported 1,024-by-768 resolutions with 24-bit colors used a TMS34020 chip; the Matrox Impression S, helped along by its proprietary ASICs, still managed to top 3 megapixels per second in this mode, while the Opta Mona-Lisa managed only about half that level of performance.

In contrast, the single VL-Bus product we saw that supported this mode, the ATI Graphics Ultra Pro VLB, produced an impressive 13 megapixels per second at 1,024-by-768 resolution with 24-bit color. Although there were no VL-Bus coprocessors in the test group, it is reasonable to expect that they will benefit as much from local-bus technology as do the fixed-function accelerators. Keep in mind that the performance of the TMS34020-based boards comes at a price; an informal round of calls to vendors selling these products showed that they typically sell from \$1,000 to more than \$3,000. Unless your Windows needs encompass programmability or true-color support (accelerators were notably lacking in drivers for the latter at 1,024-by-768 or better resolutions), or unless you're willing to pay twice the cost of an accelerator for the 30 percent or more increase that a TMS34020 will give you in some modes, you should carefully consider the investment a TMS34020 requires before making the purchase.

OTHER DESIGNS AT HIGH RESOLUTION

Only a few of the designs we tested provided drivers for resolutions above 1,024-by-768. These include, for the ISA bus, a beta version of the S3 928-equipped ISA board, supplied by Artist Graphics; the Microfield Graphics X-8, which includes a Cyprus 7C9101 coprocessor; the \$1,895 Pixelworks WhirlWIN 1600 board, which uses C&T's 82C481 accelerator; and the \$895 WinSprint 900 (with 2MB). On the EISA side, Matrox Electronic Systems provided its \$4,495 Impression Ultra, which is built around its

own 192-bit graphics engine.

The accelerated WinSprint 900 achieved 3.68 megapixels per second at 1,200-by-1,024 with 16 colors, but this was topped by the Cyprus 7C9101 coprocessor, which delivered 4.90 at the same resolution but with 256 colors. In 1,600-by-1,200 mode at 16 colors, the WhirlWIN handled 1.95 megapixels per second. The

EISA-based Matrox board eclipsed all others with its score of 2.4 at 1,200-by-1,600 mode and 24-bit color. At \$4,495, however, this board is also more than ten times the cost of many other boards in the test group.

AUTOCAD PERFORMANCE

Those who work primarily with AutoCAD or similar DOS-based CAD programs need high-resolution graphics in an environment where great demands are already being placed on the system CPU (and math coprocessor). As a result, off-loading any calculation processes to the display adapter circuitry can result in better overall performance.

As might be expected, a coprocessor equipped with a TMS34020 chip finished first in the running on our AutoCAD performance test, handling its tasks in a total of 73.14 seconds. What may be more surprising is that boards with S3 801 and 911 chips trailed only a short distance behind the leader, with high scores of 77.59 and 78.16, respectively. These scores were definitely in the minority among the S3 801, 911, and 924 class, though; most of the products based on these chips took twice as long to complete the test. More interesting was the fact that, as a class, the TI TMS34010 boards could not improve upon the performance of the accelerators. Like most of those products, the TMS34010-based devices took about the same amount of time as the accelerators to complete our AutoCAD test.

Part of the reason that the accelerators were able to match the TMS34010 coprocessors in CAD performance on the ISA bus may be that some accelerators have added CAD functions to their repertoire of built-in commands. For exam-

*With lower prices and
better performance,
some accelerators are
squeezing the
TMS34010-based
boards.*

■ What the Chips Can Do

by Ben Myers

Looking at the chip specs can give you an idea as to what type of performance you can expect from the board a chip sits on (although a good driver and top board design can make all the difference in the world). For instance, chips that have hardware to store and manipulate a bitmap pattern are big pluses for Windows and OS/2, both of which make extensive use of bitmap patterns—little 8-by-8 collections of pixels that are the essence of the crosshatching and dithering on your GUI desktop. Chips that store entire 8- by 8-bit patterns can replicate the patterns very rapidly. Less costly to burn into silicon would be a function that handles very small 2- by 2-bit and solid patterns with the same rapidity. The patterns most often used in Windows can be reduced to the simple 2-by-2 case.

Similarly, contemporary graphics chips have 32-bit registers and bus interfaces that let them handle 32-bit data, making them a natural fit for 386 and 486 PCs. By comparison, IBM's 1987-vintage VGA chip had an 8-bit register and 8-bit bus interface. Most VGA-compatible chips retained the 8-bit register bottleneck but made effective use of the 16-bit AT bus. But having a 32-bit graphics chip does not ensure really fast graphics. If graphics data has to go across a 16-bit ISA bus, the 32-bit capabilities of a chip are diminished by the bus barrier. Thus, a 32-bit graphics card mated with a 32-bit EISA-bus or VL-bus interface is an integral second part of high-performance PC graphics.

Next, the graphics chip itself must be able to sustain data rates that are less than a fraction under the bus's rated capacity. As always, software is the final enabling technology that makes a product complete. A well-written software driver needs to use 32-bit 80386 instructions, be tuned to keep the 80486 instruction pipeline flowing, and use other low-level techniques to eke out maximum performance. □

Currently Available

☒ = YES ☐ = NO

Manufacturer	ATI Technologies	Avance Logic Inc.	Chips & Technologies Inc.	Chips & Technologies Inc	Compaq Computer Corp	Headland Technology
Chip model	Mach 32 (68800)	GUIEngine (ALG2101)	Wingine (64200)	C&T 82C481	Compaq 128084	HT216
Video controller	Fixed-function accelerator	Fixed-function accelerator	Variable-size buffer controller	Fixed-function accelerator	Fixed-function accelerator	Fixed-function accelerator
Acceleration functions						
Alpha Bit Blt	■	■	□	■	■	□
Clipping	■	■	□	■	□	□
Color expansion	■	■	□	■	■	■
Hardware cursor	■	■	□	■	■	■
Color look-up table	■	□	■	□	■	■
Font rasterization (hardware)	■	■	□	■	■	□
Font rasterization (software)	■	■	□	■	■	■
Font rasterization (hardware & software)	■ ■	■ ■	□	■ ■	□ ■	□ □
Hardware scaling	32	256	Variable	Variable	16	256
Resolution	■	■	■	■	■	■
Maximum resolution (bits/pixel)	1,024 x 1,024	1,024 x 1,024	1,024 x 1,024	2,048 x 2,048	1,024 x 1,024	1,024 x 1,024
Maximum resolution (lines)	1,024	1,024	1,024	1,024	1,024	1,024
Amount and type of memory supported	4MB DRAM (16MB)	1MB DRAM	2MB VRAM	4MB VRAM	1MB VRAM	16MB DRAM
Memory data path	64-bit	32-bit	N/A	64-bit	32-bit	64-bit
Data path to memory	32-bit DRAM, 64-bit VRAM	32-bit	32-bit	32-bit	32-bit	16-bit
Data path to HAA/AC	32-bit	16-bit	8-bit	8-bit	32-bit	16-bit
Maximum clock rate (MHz)	10.5MHz	6.5MHz	5MHz	10MHz	15MHz	6.5MHz
Bus	ISA/EISA/VA Bus/VCS	ISA/EISA/VA	ISA/EISA/VA	ISA/VA	ISA/ESA	VA Bus
Selected other features	File decompression, video scaling, endpoint line draws	Endpoint line draws	—	—	Endpoint line draws	—

Coming Soon ☒ YES ☐ NO

☐ YES ☒ NO

Manufacturer	Avance Logic Inc.	Integrated Information Technology	Integrated Information Technology	Matrox Electronic Systems Ltd.	Primus Technology
Chip model	GUI-Ultra (ALG2201)	AGX-014	AGX-015	MGA	P3000
Chip set	Fixed function architecture	Fixed function architecture	Fixed function architecture	Fixed function architecture chip set	Fixed function architecture
Acceleration functions					
Alpha blending	■	■	■	■	■
Alpha test	■	■	■	■	■
Color expansion	■	■	■	■	■
Color keying	■	■	■	■	■
Color masking	■	■	■	■	■
Color palette	■	■	■	■	■
Font to pixel conversion	■	■	■	■	■
Font to data access	■ ■	■	■	■ ■	■ ■
Raster operations	256	16	16	16	16
Alpha A	■	■	■	■	■
Maximum resolution	1,280 x 1,280	1,280 x 1,280	1,280 x 1,280	1,600 x 1,200	2,048 x 1,536
Maximum image size	32-bit	32-bit	32-bit	32-bit	32-bit
Accelerator memory support	2MB RAM	2MB RAM	2MB RAM	2MB RAM	2MB RAM
Internal data path	32-bit	16-bit	32-bit	64-bit	32-bit
Data path to memory	32-bit	32-bit	32-bit	64-bit	32-bit
Data path to RAMDAC	8-bit	32-bit	32-bit	32-bit	8-bit
Maximum pixel clock	100 MHz	120 MHz	120 MHz	100 MHz	100 MHz
Buses	PCI, VL Bus	ISA, EISA, MCA	ISA, EISA, MCA, VL Bus	ISA, EISA, MCA, PCI, VL Bus	ISA
Special features		Alpha architecture	Alpha architecture	Color keying, alpha and output, printing acceleration, Gouraud shading and depth culling	Color keying, alpha and output, printing acceleration, Gouraud shading and depth culling

N/A—Not applicable. This feature is not found in this type of products. * The acceleration functions listed here are those provided by the chip using the Windows TGA driver. I—interlaced, NI—noninterlaced

HARDWARE

Graphics Adapters

Primus Technology	S3 Corp.	S3 Corp.	S3 Corp.	Texas Instruments	Texas Instruments	Weitek Corp.	Western Digital Corp.
P2000	S3 86C801	S3 86C911	S3 86C924	TI TMS34010	TI TMS34020	W5186	WD90C31
Fixed function accelerator	Fixed function accelerator	Fixed function accelerator	Fixed function accelerator	Programmable coprocessor*	Programmable coprocessor*	Fixed function accelerator	Fixed function accelerator
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
12	256	256	256	16	16	16	16
■	■	■	■	N/A	N/A	■	■
1,280 x 1,024 (I)	1,280 x 1,024 (NI)	1,280 x 1,024 (NI)	1,280 x 1,024 (NI)	4,096 x 4,096 (NI)	4,096 x 4,096 (NI)	1,024 x 768 (NI)	1,280 x 1,024 (I)
2MB DRAM	2MB DRAM	1MB VRAM	1MB VRAM	128MB DRAM or VRAM	512MB DRAM or VRAM	1MB DRAM or VRAM	1MB DRAM
32-bit	32-bit	16-bit	16-bit	32-bit	32-bit	8-bit	24-bit
32-bit	32-bit	16-bit	16-bit	16-bit	32-bit	16-bit	32-bit
8-bit	8-bit	8-bit	8-bit	16-bit	32-bit	8-bit	8-bit
80 MHz	110 MHz	80 MHz	110 MHz	100 MHz	200 MHz	80 MHz	80 MHz
ISA	ISA	ISA EISA MCA	ISA EISA MCA	ISA EISA	ISA EISA	ISA	ISA EISA MCA
—	Genlock	—	—	—	—	—	—

S3 Corp.	S3 Corp.	Trident Microsystems	Trident Microsystems	Tseng Laboratories	Weitek Corp.	Weitek Corp.	Western Digital Corp.
S3 86C805	S3 86C920	Storm DG TGU19420	Storm VG TGU19430	ET4000/W32	W5286	Power9000	WD90C33
Fixed function accelerator	Fixed-function accelerator	Fixed function accelerator	Fixed-function accelerator	Fixed-function accelerator	Fixed function accelerator	Fixed function accelerator	Fixed function accelerator
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
256	256	256	256	256	16	256	16
■	■	■	■	■	■	■	■
1,280 x 1,024 (NI)	1,600 x 1,200 (NI)	1,280 x 1,024 (NI)	1,280 x 1,024 (NI)	1,280 x 1,024 (I)	1,280 x 1,024 (I)	1,600 x 1,280 (NI)	1,280 x 1,024 (NI)
24-bit	24-bit	24-bit	24-bit	32-bit	24-bit	32-bit	24-bit
2MB DRAM	4MB VRAM	2MB VRAM	2MB DRAM	4MB DRAM	1MB DRAM or VRAM	4MB VRAM	2MB DRAM
32-bit	32-bit	32-bit	32-bit	32-bit	8-bit	64-bit	32-bit
32-bit	32-bit	32-bit	32-bit	32-bit	32-bit	32-bit	32-bit
8-bit	64-bit	8-bit	8-bit	16-bit	8-bit	32-bit	8-bit
110 MHz	145 MHz	108 MHz	108 MHz	87 MHz	80 MHz	200 MHz	85 MHz
ISA, 386 or 486 local bus, VL-Bus	ISA EISA 386 or 486 local bus VL-Bus	ISA, MCA, VL Bus	ISA, MCA, VL Bus	ISA, EISA, MCA, 386 or 486 local bus, VL Bus	ISA	ISA EISA, MCA, VL-Bus	VL Bus
Genlock	Genlock	—	—	Multiple hardware windows	—	—	—

FOR WINDOWS

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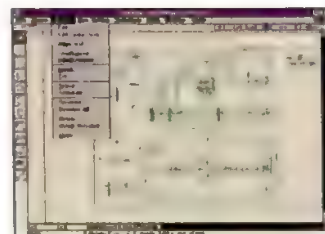
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Graphics Adapters

ple, CAD programs use a different algorithm for drawing lines: an endpoint-to-endpoint method known as the Bresenham algorithm. This differs from the point-to-point method used by the Windows GDI (Graphics Device Interface). This added level of functionality to the accelerator class casts further doubt on the possibility of an extended future for TMS34010-based products.

The best accelerators can keep up with TMS34020 coprocessors in AutoCAD, in part because of the quality of their display list drivers. Display list drivers make it possible for the display adapter to store the vectors for all the lines in a drawing, using the memory on the adapter card. As a result, the CPU does not need to send all the information about a drawing every time; the processor on the video board can recreate the drawing using the data that it already has. The end result is fast pan and zoom speeds that rival those of high-end adapters, but at a fraction of the cost.

The advantage of the VL-Bus does not appear to hold up on the AutoCAD test, however. On our test, the VL-Bus did show about a 20 percent reduction in time for the Mach 32 (104.93 seconds for the Graphics Ultra Pro versus 80.80 for the Graphics Ultra Pro VLB Mach 32-V) and about a 17 percent difference between the best S3 801 ISA implementation and the S3 805 chip optimized for the local bus (77.59 versus 65.04). But these differences were less than the 33 percent increase provided by the faster 486/33 processor.

The results of our AutoCAD test also indicated that the EISA cards we saw were actually slower in this mode than their ISA siblings were, but this may again be due to the drivers and not the bus type. Even though EISA expansion boards mimic ISA expansion boards (all signals are constrained by the bus), EISA's 32-bit data transfers should lead to speedier performance. However, if the drivers are not optimized to take advantage of the characteristics of the bus and of each chip, these performance differences will not be apparent.

OTHER APPLICATIONS

If your primary needs do not match any of these profiles, you should consider looking at other cards that are targeted

for specialized applications. There are too many categories and variables for us to provide comprehensive testing of all the different kinds, but they deserve mention.

Three-dimensional modeling and rendering are staples in the AutoCAD world, but products like AutoDesk 3D Studio add 3-D animation to the picture

With strong display list drivers, the end result is fast pan and zoom speeds that rival those of high-end adapters, but at a fraction of the cost.

as well. Each of these operations is among the most computationally intensive of all applications: Since the computer needs to keep track of points where one object passes in front of another, the boards have to handle hidden line and clipping functions rapidly. The fundamental calculations themselves tend to rely more heavily on floating point operations than the integer operations used by two-dimensional imaging. In addition, adequate-quality rendering and animation requires deep color to facilitate smooth shading and minimize palette conflicts.

Boards that have been designed to handle these tasks often use TI 340x0 family or proprietary coprocessors and are often supplemented by additional processing power on the board, such as hardware assists to handle different shading algorithms. For example, the \$4,495 Matrox MG-3D Ultra is designed for 3-D applications. In addition to custom ASIC processors, it also comes with a separate math coprocessor on-board to handle part of the heavy number crunching. Matrox has taken this high-end technology and incorporated some of it into its MGA chip set, which will provide essentials like 3-D acceleration, depth cueing, and Gouraud shading.

Similarly, Pellucid is developing and marketing what was once Silicon Graphics' IRISvision product. The \$2,795 ISA

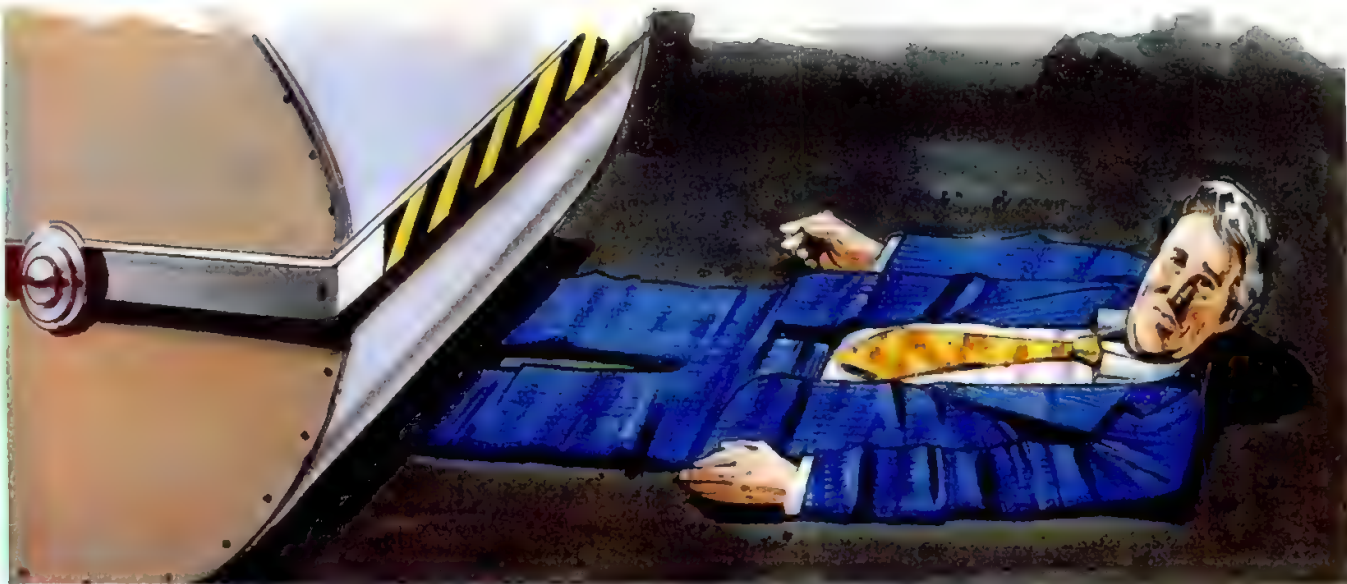
version, two-board device (\$3,995 for 24-bit color support) uses Silicon Graphics' Geometry Engine and custom VLSI chips to provide real-time 3-D operations; it even supports StereoGraphics' LCD shutter stereo viewing technology. RasterOps takes a different approach with its PaintBoard PC, a \$1,299 list price board that speeds up 3-D graphics operations by using three S3 924 chips on a single board.

True multitasking operating systems—such as OS/2, Unix with X Windows, and Windows NT—require additional capabilities over simple GDI accelerators. These operating systems also place great demands on CPU processing power—especially as the number of simultaneous tasks increase—so self-sufficient display adapters should have a performance advantage. Microfield Graphics is one company addressing this market with graphics adapters based on coprocessor and ASIC technology (like the X-8 tested here), which place minimal demands on the host application processor to drive the display. This means that performance should degrade more slowly than other designs as the load on the system CPU increases.

THE FUTURE

As if handling computer-generated graphics weren't enough for our overloaded display subsystems, the growing use of video is the final straw that breaks the back of a number of existing technologies. The new generation of chips includes capabilities geared toward increasing the throughput of video images and aimed at making animations run more smoothly.

For instance, the Mach 32 contains built-in support for Microsoft's Audio-Video Interleave (AVI) in the form of a built-in RLE decompressor (RLE is the run-length encoded compressed format used for animations). And Pellucid's IRISvision (among others) has hardware support for double-buffering. This allows the board to store a fully rendered animation frame in memory, where it awaits its turn for display. Otherwise, the board rasterizes the animation on the fly, which can result in jerkiness. The IRISvision board also supports motion interpolation, which can speed up the display of digitized videos.



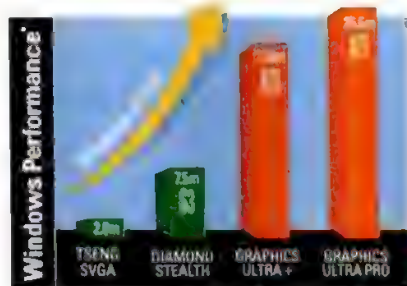
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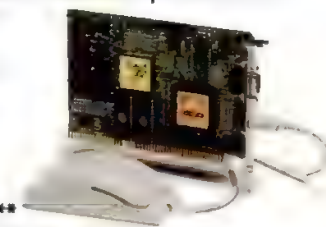
mach 32



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► SUMMARY OF FEATURES

Accelerated Graphics Adapters



In a phabetical order by company							
	Actix GraphicsEngine 1280	Artist Graphics WinSprint 100+	ATI Graphics Ultra Plus	ATI Graphics Ultra Pro	Cache Computers Lynx VGA Model 336	Cardinal VGA 900 High Color Windows Accelerator	
List price	\$349	\$495	\$499	\$799	\$395	\$349	
In short	Relatively expensive for a middle-of-the-pack 32,000-color board.	High throughput matched by a high price. For \$495, it should at least offer high-color support.	A high-color, high-throughput champion.	A high-resolution, 24-bit speed demon that suffers from shaky drivers.	A middle-of-the-road card that could use better documentation and software support.	A board that places substance above style. Its throughput is acceptable and its drivers are stable.	
Graphics accelerator chip	S3 P86C924	S3 P86C924	Mach 32	Mach 32	S3 86C911	S3 P86C911A	
VGA BIOS manufacturer	Actix/AMI	AMI	ATI	ATI	AMI	AMI	
VGA pass-through connector	Dual-pin	Dual-pin	Dual-pin	Dual-pin	Dual-pin	Dual-pin	
Hardware cursor	☐	☒	☒	☒	☒	☒	
Display Characteristics							
Maximum graphics resolution	1,280 x 1,024 (NI)	1,280 x 1,024 (I)	1,280 x 1,024 (I)	1,280 x 1,024 (NI)	1,280 x 1,024 (I)	1,280 x 1,024 (I)	
Maximum text resolution	132 x 43	132 x 43	132 x 43	132 x 43	132 x 43	132 x 43	
Supported resolutions:							
1,280 x 1,024 (noninterlaced)	☒	☐	☐	☒	☐	☐	
1,280 x 1,024 (interlaced)	☒	☒	☒	☒	☒	☒	
1,024 x 768	☒	☒	☒	☒	☒	☒	
800 x 600 (Super VGA)	☒	☒	☒	☒	☒	☒	
VESA support	BIOS	BIOS	BIOS	BIOS	BIOS	TSR	
Display memory	2MB 80-ns VRAM	1MB 80-ns VRAM	2MB 80-ns DRAM	2MB 80-ns VRAM	1MB 80-ns VRAM	1MB 80-ns VRAM	
Amount supported on-board	1MB	1MB	1MB-2MB	1MB-2MB	512K-1MB	512K-1MB	
Maximum color depth in Windows	16-bit	8-bit	24-bit	24-bit	15-bit	16-bit	
RAMDAC model	Sierra 11483CV	AT&T C491	ATI 68875	ATI 68875	Sierra 11486DV	AT&T C491	
Virtual display	☐	☒	☒	☒	☐	☐	
Included Software Drivers							
8514/A	☐	☐	☒	☒	☐	☐	
AutoCAD:							
Protected-mode ADI driver	☒	☒	☒	☒	☒	☒	
Display list processor	☒	☒	☒	☒	☒	☐	
Other CAD programs	☒	☒	☒	☒	☒	☐	
Lotus 1-2-3	☒	☒	☒	☒	☒	☒	
OS/2 Presentation Manager	None	None	1 x, 2 0	1 x, 2 0	None	None	
Ventura Publisher (GEM)	☒	☐	☒	☒	☒	☐	
WordPerfect/Microsoft Word	☒ ☒	☒ ☒	☒ ☒	☒ ☒	☒ ☒	☒ ☒	
Customer Support							
Toll-free technical support	☒	☒	☐	☐	☐	☒	
Technical support hours (eastern time)	12:00 noon-9 00 P.M. M-F	9 00-6 00 M-F	8 00-5:30 M-F	8 00-5:30 M-F	11:00-8:00 M-F	8 00-5:00 M-F	
BBS	☒	☒	☒	☒	☐	☒	

N/A—Not applicable. This product does not have on-board VGA.
I—interlaced, NI—noninterlaced

HARDWARE

Graphics Adapters

Celerite Galaxy 2000	Compaq QVision 1024/I	Diamond SpeedSTAR 24X Graphics Adapter	Diamond Flower VG-8000WH	Edge V24 BitBlaster	Focus 2 the Max VGA GUI 6000	Hercules Graphics Station Gold 16+2	Hercules Graphics Station Gold 24+2
\$139	\$375	\$249	\$189	\$199	\$360	\$579	\$679
Inexpensive but a slow performer, particularly at high-color depths.	A solid if lackluster Windows and AutoCAD performer that's better suited for DOS acceleration.	A high-resolution true-color board at a good price	Inexpensive, but a shaky performer with rough installation.	An average performer in 256-color modes, but its high-color drivers are unstable and its install arduous.	Spotty performance makes this one tough to recommend.	A pass-through card that promises a lot more Windows performance than it delivers. It's strong for AutoCAD, however.	Performs the same as the 16+2 but costs more and handles 24-bit color only at nonstandard resolutions.
P2000	C128084-004	WD-90C31-LR	WD-90C31-LR	S3 86C924	S3 86C911	TI TMS34010	TI TMS34010
Quadtel	Compaq	Diamond Computer	Western Digital	AMI	Focus	N/A	N/A
Dual-pin	Edge	Dual-pin	Edge	Dual-pin	Dual-pin	N/A	N/A
■	■	■	■	■	■	N/A	N/A

1,280 x 1,024 (I)	1,024 x 768 (NI)	1,280 x 1,024 (I)	1,280 x 1,024 (I)	1,280 x 1,024 (NI)	1,280 x 1,024 (I)	1,024 x 768 (NI)	1,024 x 768 (NI)
132 x 60	132 x 50	132 x 50	132 x 43	132 x 43	132 x 43	N/A	N/A
□	□	□	□	■	□	□	□
■	□	■	■	■	■	□	□
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
BIOS	BIOS	BIOS	BIOS, TSR	BIOS	None	None	None
1MB 60-ns DRAM	1MB 80-ns DRAM	1MB 70-ns DRAM	1MB 70-ns DRAM	1MB 80-ns VRAM	1MB 80-ns VRAM	2MB 80-ns DRAM, 1MB 100-ns VRAM	2MB 80-ns DRAM, 1MB 100-ns VRAM
1MB-2MB	1MB	1MB	1MB	1MB	1MB	3MB	3MB
24-bit	24-bit	24-bit	15-bit	24-bit	16-bit	15-bit	24-bit
AT&T C491	Brooktree 484KP	Diamond 2410	Analog Devices 476KB	AT&T C491	Music 9C4870	Sierra 11481	Brooktree 473KP
□	□	□	□	□	□	□	□

□	□	□	□	■	□	□	□
■	■	■	■	■	■	■	■
■	■	■	□	□	□	■	■
■	□	■	□	■	■	□	□
■	□	■	□	■	■	□	□
None	1.21, 1.3	1.3, 2.0*	1.x	None	None	None	None
■	□	□	□	□	□	□	□
■ □	□ □	■ ■	□ □	■ ■	■ ■	□ □	□ □

■	■	□	□	■	□	□	□
11:00-8:00 M-F	8:00 A.M.-8:00 P.M. M-F	9:30-8:30 M-F	11:00-8:30 M-F	9:00 A.M.-9:00 P.M. M-F	11:00-8:00 M-F	10:00-8:00 M-F	10:00-8:00 M-F
■	■	■	■	■	■	■	■

* Available on request

CONTINUES

HARDWARE

Graphics Adapters

► SUMMARY OF FEATURES

							
In alphabetical order by company	Hercules Graphics Station Card, Model GB1024+2	IOcomm Michaelangelo VRAM	Kingston View Rx	Matrox HiPer-VGA	Matrox Impression 1024	Matheus Premier 1280NI	
■ = YES □ = NO							
List price	\$699	\$450	\$149	\$299	\$695	\$399	
In short	Has a less stable image than its Gold cousins, but performs only marginally better and costs more.	A souped-up 911 card that delivers good performance at the cost of unreliable operation.	Limited resolutions and subpar Windows throughout not offset by the low price.	Performs on a par with its pricier sibling—solidly if not spectacularly—and costs less.	High-res true color on a budget. But if all you need is 256 colors, this costs more than you need to spend.	An excellent performer with superior documentation and driver support.	
Graphics accelerator chip	TI TMS34010	S3 86C911	W5186	S3 86C924	S3 86C911	S3 86C924	
VGA BIOS manufacturer	Hercules	IOcomm/AMI	Kingston	S3/Matrox	S3/Matrox	AMI	
VGA pass-through connector	Dual-pin	Dual-pin	Dual-pin	Dual-pin	None	Dual-pin	
Hardware cursor	□	■	□	■	■	■	
Display Characteristics							
Maximum graphics resolution	1,024 x 768 (NI)	1,280 x 1,024 (NI)	1,024 x 768 (NI)	1,280 x 1,024 (I)	1,024 x 768 (NI)	1,280 x 1,024 (NI)	
Maximum text resolution	80 x 50	132 x 43	132 x 60	132 x 43	132 x 43	132 x 43	
Supported resolutions:							
1,280 x 1,024 (noninterlaced)	□	■	□	■	■	■	
1,280 x 1,024 (interlaced)	□	■	□	■	■	■	
1,024 x 768	■	■	■	■	■	■	
800 x 600 (Super VGA)	■	■	■	■	■	■	
VESA support	None	BIOS	TSR	BIOS	BIOS	BIOS	
Display memory	2MB 80-ns DRAM, 1 MB 100 ns VRAM	1MB 80-ns VRAM	512K 80-ns DRAM	1MB 80-ns VRAM	3MB 80-ns VRAM	1MB 80-ns VRAM	
Amount supported on-board	3MB	1MB	512K	1MB	3MB	512K-1MB	
Maximum color depth in Windows	24-bit	16-bit	8-bit	15-bit	24-bit	15-bit	
RAMDAC model	Brooktree 473KP	Sierra 11486DV	Brooktree 475KP	Sierra 11483CV	Brooktree 484	Sierra 11483CV	
Virtual display	□	□	□	■	■	□	
Included Software Drivers							
8514/A	□	□	□	□	□	□	
AutoCAD:							
Protected-mode ADI driver	■	■	■	■	■	■	
Display list processor	■	■	□	■	■	■	
Other CAD programs	□	■	□	■	■	■	
Lotus 1-2-3	□	■	■	■	■	■	
OS/2 Presentation Manager	None	None	None	None	None	None	
Ventura Publisher (GEM)	□	■	■	■	■	■	
WordPerfect/Microsoft Word	□ □	■ ■	■ ■	■ ■	■ □	■ ■	
Customer Support							
Toll-free technical support	□	■	□	■	■	■	
Technical support hours (eastern time)	10:00-8:00 M-F	11:30-8:30 M-F	11:00-8:00 M-F	8:00 A.M.-9:00 P.M. M-F	8:00 A.M.-9:00 P.M. M-F	9:00-6:00 M-F	
BBS	■	□	■	■	■	■	

N/A—Not applicable: This product does not have on-board VGA
I—interlaced, NI—noninterlaced

HARDWARE

Graphics Adapters

PC EDITORS' CHOICE

Mylex GLI911	NDI Volante AT600 Plus	NDI Volante AT1000	NDI Volante Warp10	Orchid Fahrenheit 1280* Windows Graphics Accelerator	Portacom Eclipse II	Presenta Graphics Accelerator VGA	Prism Accelerator X-VGA
\$360	\$395	\$995	\$299	\$399	\$294	\$399	\$149
Might be competitive with improved software. For now, its performance is uninspiring.	An excellent performer whose speedy AutoCAD display list driver is an exceptional asset.	Great performance but also expensive. This card is better for AutoCAD than for Windows use.	Has potential, but a few display glitches prove it isn't quite ready.	Not exceptional, but delivers solid performance up to 24-bit color depth.	Average Windows throughput coupled with well-below-average AutoCAD times and poor installation procedure.	Better at AutoCAD than at Windows acceleration but a bit pricey for what it delivers.	Looks like a bargain but exhibits some serious shortcomings under stress.
S3 86C911	S3 86C924	Ti TMS34020	S3 C86C801	S3 86C911	S3 86C911	S3 86C911A	ALG2101
S3	AMI	National Design	S3	AMI/Orchid	AMI/Portacom	AMI	Quadtel
Edge	Dual-pin	Dual-pin	Dual-pin	Dual-pin	Edge	Dual-pin	Dual-pin
■	■	■	■	■	■	■	■

1,024 x 1,024 (I)	1,280 x 1,024 (NI)	1,024 x 768 (NI)	1,280 x 1,024(I)	1,280 x 1,024 (I)	1,280 x 1,024 (NI)	1,280 x 1,024 (NI)	1,280 x 1,024 (I)
132 x 43	132 x 43	132 x 43	132 x 43	132 x 44	132 x 43	132 x 43	132 x 43
□	■	□	□	□	■	□	□
■	■	□	■	■	■	■	■
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
BIOS	BIOS	BIOS	BIOS	BIOS	BIOS	TSR	BIOS
1MB 80-ns VRAM	1MB 80-ns VRAM	256K 80-ns DRAM, 768K 75-ns VRAM	1MB 80-ns DRAM	1MB 80-ns VRAM	1MB 70-ns VRAM	1MB 80-ns VRAM	1MB 60-ns DRAM
1MB	1MB	1MB	1MB	512K-1MB	1MB	1MB	1MB
8-bit	15-bit	8-bit	24-bit	24-bit	8-bit	8-bit	16-bit
Music C9870V	Sierra 11483CV	Samsung 478PL	AT&T C491	AT&T C491	Brooktree 471	Sierra 11483CN	Avance Logic 1101
□	□	■	□	■	□	■	■

□	□	□	□	□	□	□	□
■	■	■	■	■	■	■	■
□	■	■	■	■	■	□	■
■	■	□	■	■	□	■	□
■	■	□	■	■	■	■	□
None	None	None	None	2.0	None	None	None
■	■	□	■	■	■	□	■
■ ■	■ ■	□ □	■ ■	■ ■	□ □	■ ■	□ □

■	■	■	■	□	■	□	□
11:00-8:00 M-F	9:00-6:00 M-F	9:00-6:00 M-F	8:00-5:00 M-F	10:00-8:00 M-F	11:00-8:00 M-F	11:00-8:00 M-F	11:00-8:00 M-F
■	■	■	■	■	□	□	■

CONTINUES

HARDWARE

Graphics Adapters

► SUMMARY OF FEATURES

In alphabetical order by company							
	Pycon WinJet Edge Graphics Accelerator	Quickpath Cyclone XGi	Sigma Designs Legend GX	STB PowerGraph X-24	STB Wind/X HC GUI Accelerator	Tangram TANXcell-GUI	
List price	\$459	\$329	\$329	\$249	\$379	\$145	
In short	Has the throughput of a thoroughbred but could use some application drivers to help tame it.	Dreadful at AutoCAD and adequate at Windows. It lacks support for 256-color SVGA mode.	Mediocre throughput, an unstable 32,000-color driver, and an unusable AutoCAD driver.	High Windows throughput, but it lacks a working AutoCAD driver. The hardware is willing but the software is weak.	Decent high-color Windows throughput, but a failure at handling AutoCAD.	Displayed obvious flaws during testing, like unstable drivers and subpar Windows throughput.	
Graphics accelerator chip	C&T 82C481	S3 86C924	S3 P86C924	S3 C86C801	S3 86C911	ALG2101	
VGA BIOS manufacturer	C&T	S3	Sigma Designs	STB	STB	Avance Logic	
VGA pass-through connector	Dual-pin	Dual-pin	None	Dual-pin	None	Dual-pin	
Hardware cursor	■	■	■	■	■	■	

Display Characteristics

Maximum graphics resolution	1,024 x 768 (NI)	1,280 x 1,024 (I)	1,280 x 1,024 (NI)	1,280 x 1,024 (I)	1,280 x 1,024 (I)	1,280 x 1,024 (I)	
Maximum text resolution	132 x 43	132 x 43	132 x 43	132 x 60	132 x 60	132 x 60	
Supported resolutions:							
1,280 x 1,024 (noninterlaced)	□	□	■	□	□	□	
1,280 x 1,024 (interlaced)	□	■	■	■	■	■	
1,024 x 768	■	■	■	■	■	■	
800 x 600 (Super VGA)	■	■	■	■	■	■	
VESA support	TSR	BIOS	TSR	BIOS	BIOS	BIOS	
Display memory	1MB 70-ns VRAM	1MB 70-ns VRAM	1MB 80-ns VRAM	1MB 60-ns DRAM	1MB 70-ns VRAM	1MB 120-ns DRAM	
Amount supported on-board	1MB	1MB	1MB	1MB	1MB	1MB	
Maximum color depth in Windows	24-bit	15-bit	15-bit	24-bit	15-bit	16-bit	
RAMDAC model	Brooktree 482	Sierra 11483	Music 9C4870V	AT&T C491	Sierra 11483	Avance Logic ALG1101	
Virtual display	□	□	■	□	□	■	

Included Software Drivers

8514/A	□	□	□	□	□	□	
AutoCAD							
Protected-mode ADI driver	□	■	■	■	■	■	
Display list processor	□	□	■	□	■	■	
Other CAD programs	□	■	□	■	■	■	
Lotus 1-2-3	□	■	■	■	■	■	
OS/2 Presentation Manager	None	None	None	None	None	None	
Ventura Publisher (GEM)	□	■	■	■	■	■	
WordPerfect/Microsoft Word	□ □	□ ■	■ ■	■ ■	■ ■	■ □	

Customer Support

Toll-free technical support	■	■	□	□	□	□	
Technical support hours (eastern time)	12 00 noon-8 00 P.M. M-F	11 30-3 00 M-F	11 00-8 00 M-F	9 00-7 00 M-F	9 00-7 00 M-F	10 00-8 00 M-F	
BBS	■	□	■	■	■	□	

N/A—Not applicable. This product does not have on-board VGA.
I—interlaced. NI—noninterlaced.

Video Seven WIN.VGA	VidTech WinMax	WD Paradise Accelerator Card for Windows
\$159	\$299	\$249
Acceptable Windows throughput at this price.	Competent Windows throughput and a reasonable price; poor AutoCAD performance, however.	May not give you the highest throughput, but it will give you problem-free performance.
HT216	W5186	WD-90C31-LR
Headland	Phoenix	Western Digital
Dual-pin	Dual-pin	Edge
■	■	■

1,024 x 768 (NI,I)	1,024 x 768 (NI)	1,280 x 1,024 (I)
132 x 43	132 x 43	132 x 43
□	□	□
□	□	■
■	■	■
■	■	■
TSR	BIOS	BIOS
MB 80-ns DRAM	1MB 80-ns VRAM	1MB 70-ns DRAM
512K-1MB	512K-1MB	1MB
8-bit	15-bit	15-bit
Inmos SG176	Sierra 11483	Sierra 11483CV
□	□	□

□	□	□
■	■	■
□	■	□
■	□	■
■	■	■
1.2	None	None
■	■	□
■ ■	■ ■	□ ■
■	■	□
11:00-8:00 M-F	9:00-6:00 M-F	11:00-8:00 M-F
■	■	■

ENDS

Boards that allow you to send out computer display images as composite (NTSC) video so that it can be played on a VCR or displayed on a regular television monitor have been around for years. But now we're finally starting to see PC graphics chip sets that start to integrate support for genlocking, an essential feature used for overlaying PC graphics over

*Manufacturers are also
adding digital sound
to video cards so that
you can have
multimedia functions on
a single card.*

video (for reviews of boards that perform this function, see "VGA-to-NTSC Boards: Let's Go to the Videotape" in the September 29, 1992, issue of *PC Magazine*). S3's 801, 805, and 928 processors currently have genlocking, although it's up to individual board vendors to include the necessary supporting logic.

Conversely, there are boards that can display motion video in a window on-screen. This allows you to view broadcast or taped video images while working with applications on the computer. It also lets you capture images to include in printed documents. Creative Labs' \$499.95 VideoBlaster offers one of the lowest-cost—and lowest-quality—options for video windowing. You can expect to see many new products in this category in the coming year, especially new designs that can digitize live video images and place them directly in video display memory.

And manufacturers are also adding digital sound to video cards so that you can have multimedia functions on a single card. For example, the TrueVision Bravado multimedia board accepts up to three simultaneous composite or S-video signals and can display them on-screen in separate windows. There is also a pass-through audio feature, with provisions for adding digital audio modules in the future. Videomail has a \$495 DigiTV card that includes a TV tuner, high fidelity stereo amplifier, and full motion video

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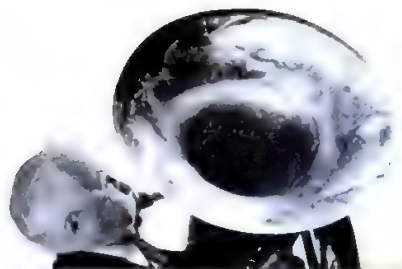
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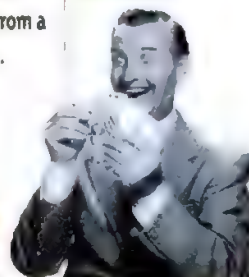
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Best Buy,
December 1992

Desktop	CPU	RAM-MB	HD-MB	Floppy	Display	Price
386DX/33	Intel 80386DX-33 MHz	1 standard 32 max	40	1.2 or 1.44	16 bit SVGA card 14" 640x480 VGA Color Monitor	\$849 \$32/mo*
386DX/33 or 486SX/25	Intel 80386DX-33 MHz or Intel 80486SX-25 MHz, with built-in 8K CPU cache	2 standard 32 max	80	as above	as above	\$999 \$37/mo*
486SX/25	Intel 80486SX-25 MHz Built-in 8K CPU cache	as above	80	1.2 & 1.44	16 bit SVGA card 14" 1024x768 SVGA Color Monitor	\$1,199 \$44/mo*
386DX/33 CACHE	Intel 80386DX-33 MHz 64K CPU cache	4 standard 32 max	120	as above	16 bit SVGA card & Hi-Color Support, 14" 1024x768 SVGA 28 Interlaced Color Monitor	\$1,399 \$52/mo*
486SX/33	Intel 80486SX-33 MHz 8K CPU cache	as above	120	as above	as above	\$1,499 \$56/mo*
486DX/33 CACHE	Intel 80486DX-33 MHz 128K CPU cache	as above	120	as above	16 bit SVGA card, 1MB Video RAM & Hi-Color Support, 14" 1024x768 SVGA Non-Interlaced Multisync Color Monitor	\$1,799 \$67/mo*
486DX/50 CACHE	Intel 80486DX-50 MHz 128K CPU cache True 50 MHz CPU	as above	120	as above	as above	\$1,999 \$74/mo*
486DX/66 CACHE	Intel 80486DX2-66 MHz 128K CPU cache New Double Clock CPU	8 standard 32 max	200	as above	16 bit SVGA Superfast Windows Accelerator card, 1MB RAM, 14" 1024x768 SVGA Non-Interlaced Multisync Color Monitor	\$2,499 \$93/mo*

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window capabilities, in effect putting a television set in your computer and on your screen.

Like these video cards, graphics adapters are also beginning to add sound to sight. For instance, Orchid's \$299 S3 801-based Fahrenheit VA, has voice recording (this board shipped too late for inclusion in the product roundup, but we were able to test it for the technology survey).

As rich as all these offerings may appear, the future holds the promise of even greater display performance. The modular design of the Matrox MGA will allow it to accept add-on modules for laser-printer acceleration and desktop video. The boards will come in ISA and VL-Bus versions, with list prices between \$500 and \$1,300, and are expected to begin shipping in early 1993.

Independent of the video chips used on these boards is an additional factor lurking just over the horizon. Intel is expected to release its PCI bus specification, which will compete with the VL-Bus spec for the position of local-bus standard. As with the VL-Bus, the PCI bus spec is designed to run at speeds up to 33 MHz and can be incorporated in motherboards with ISA, EISA, or MCA architecture. The PCI spec supports more peripherals than the current version of the VL-Bus: up to 10 peripherals compared with 3. The PCI spec also defines 32-bit or 64-bit data connections; 64-bit support is slated for a future version of the VL-Bus. Until we see PCI in action with a display card, we can't tell if it will perform faster than the VL-Bus. And then there is still the question of whether the buying public will prefer PCI over the VL-Bus, no matter which specification is technically better.

Based on the first ten years of PC use, we can safely assume that we're not about to stop seeking faster performance, more colors, and higher resolution from our computers any time soon. The fact is, we have a wide range of choices for graphics adapters that can meet most of our current needs. The key to picking the right graphics card for you is to know what you want to use it for and how much you are willing to spend. There are many differences between how these cards perform; choosing carefully can have a major impact on the speed of your screens.

ACCELERATORS

Bringing Windows Up to Warp Speed

by John R. Quain

N

othing excels like a graphics accelerator. Dollars for pixels, accelerators are the best upgrade bargains available for your PC. That was true a year ago, and it's even more true now. For instance, most of the S3 911-based products we test here will be sporting the newer 924 chip by the time you read this; boards with new Avance Logic, Primus, Weitek, and Western Digital chips will also follow suit.

This year, the market for such inexpensive Windows boosters has grown tremendously. We turned up a plateful of GUI accelerators to consider that were all less than \$1,000; these 33 adapters ranged from Celerite Graphics' \$139 Galaxy 2000 to ATI Technologies' \$799 ATI Graphics Ultra Pro.

If that weren't enough, the prices of coprocessed graphics adapters have begun to fall low enough so that four products—three TI TMS34010-based cards from Hercules that range in price from \$579 to \$699, and one TI TMS34020-based card from National Design (\$995)—met our evaluation criteria. Though the price range appears broad, mail-order and retail competition are great levelers. So expect to see many of the more expensive adapters discounted by as much as 25 percent.

The primary edge this group of graphics accelerators has is in Windows performance. Screens will open and close more quickly, scrolling through a huge spreadsheet will take seconds rather than minutes, and icons will dart around the display at your beck and call.

Overall, despite software headaches

and glitches, this group of accelerators offers the best graphics performance for your money. Though one coprocessed board, National Design's TI TMS34020-based Volante AT1000, placed sixth in Windows performance among all the adapters in this roundup, its \$995 price tag all but eliminates it from the competition if all you need is Windows acceleration. GUI accelerators are available for less than half the price, and they have proved a boon to buyers looking for better graphics performance.

Not all the accelerators can translate this performance gain in other environments, however. Adapters based on fixed-function accelerators, for example, can't compete with many standard VGA adapters for DOS tasks; and while Video Seven's HT216-based WIN.VGA and the boards using the WD90C31 chip outperform the other accelerators at DOS tasks, their Windows performance can't quite keep up. Coprocessed cards, which use either a frame-buffer VGA chip or card for their VGA work, can offer users the best of both worlds.

Furthermore, while many in this group offer zippy AutoCAD performance, some controllers fall significantly behind coprocessed graphics cards. But as more chips offer acceleration for CAD-specific algorithms, this performance gap narrows. In the boards we look at here, only the expensive TI TMS34020-based Volante AT1000 shows a clear advantage for CAD while still offering good Windows and DOS performance. Because GUI accelerators have predetermined functions—coprocessed adapters, in contrast, can execute a C program and support separate memory for holding display list information—GUI accelerators are by design less

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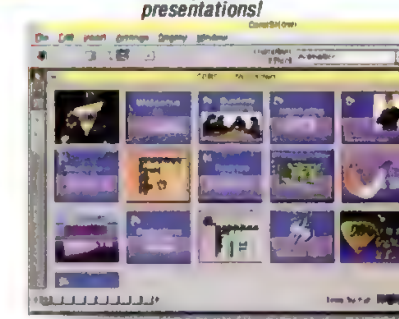
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flexible. Thus, you will want to make sure you choose the adapter most suited to the environment in which you intend to spend most of your time.

Since they are not programmable, these GUI accelerators are video adapters for users who want one thing: a quick, easy performance upgrade. This makes them the popular choice for PC users—and there's a lot of choosing to do. The performance of these products improves on a nearly weekly basis, with new-chip introductions, new board makers, and continual software driver revisions—all designed to squeeze a little more performance out of the adapters.

Practically all the accelerators we tested improve Windows performance by two to eight times over standard VGA controllers. With rare exceptions, all the adapters can display noninterlaced resolutions up to 1,024-by-768 pixels with 256 colors. Many offer high-color (32,768 colors) drivers for more realistic images, and a few include 24-bit color (16.8 million colors) capabilities.

If you desire such photo-realistic color

depths, you should be aware that the accelerators, such as adapters founded on S3's 86C924 chip, have significant limitations. A 24-bit color image in Super VGA requires 1.4MB of memory per screen. If you have a 17- or 20-inch monitor and want 1,280-by-768 resolution with 16.8 million colors, a single screen of 24-bit color can take 2.3MB of memory. But most of the boards come with only 1MB of display memory; most of the chips only support 1MB or 2MB, although ATI's Mach 32 and the Chips & Technologies 82C481 can support up to 4MB.

In addition, most of the accelerators with 32,768- or 64,000-color drivers reduced their vertical refresh rates below the eye-saving 72-Hz refresh rate in these modes. Furthermore, most accelerators don't support the full range of acceleration functions for 24-bit color operations. So if you only occasionally need to display deep-color images, look for an accelerator that comes with the appropriate software driver—and expect slower performance.

In general, we found that this group

of accelerators delivered on the promise of better Windows performance. Leading the pack were offerings from ATI and Pyccon and two boards based on S3's latest 86C801 chip: STB's PowerGraph X-24 and NDI's Volante Warp10.

The leaders were not without their shortcomings, however, and there's plenty to consider among the less-expensive yet more mature products that are based on well-established video accelerator chips. Notable in this category are S3's 86C911 chip and its pin- and driver-compatible replacement, the 86C924. (An early lot of the 924 chips was stamped as S3911A; though we preserved this distinction in the features table to accurately reflect the products we evaluated, the 911A and the 924 are identical.)

In no case did we consider only benchmark test results. Buyers should look for comments on overall ease of use and functionality. With so many choices, buyers should have no trouble avoiding the models that are missing important features or that are inordinately difficult to use.



The quickest way
between two points used to be
a straight line.

Top Accelerators

BY JOHN R. QUAIN

Outstripping all others in the pixel-performance race was Picon's \$459 WinJet Edge Graphics Accelerator. Unique among the adapters we tested, the Picon board is based on the Chips & Technologies (C&T) 82C481 graphics accelerator. With this fixed-function processor, Picon turned in a Graphics Winmark test score of 8.94 megapixels per second.

In addition to the 82C481 chip and 1MB of VRAM, the WinJet also employs C&T's Wingine chip. While it was originally developed to provide linear addressing for a motherboard-based graphics architecture, in this case the Wingine acts as a VGA register level-compatible controller rather than supplying a larger memory space or accelerated functions. Unlike the S3 chips, which have VGA compatibility built in, C&T's 82C481 does not provide VGA compatibility.

Picon's implementation was clearly

incomplete at the time of testing. No AutoCAD driver was available for evaluation. And, aside from the standard VGA mode, the adapter only included drivers for two resolutions under Microsoft Windows: Super VGA with 256 colors and 1,024-by-768 resolution with 256 colors. (We received an AutoCAD driver as well as driver support for more Windows modes after the testing period, however.) The adapter also lacks a standard VESA BIOS, so some anomalies were detected in backwards-compatibility tests. We also found Picon's documentation wanting.

Despite these shortcomings—and Picon's less-than-complete implementation of the C&T design—this latest entry into the GUI accelerator wars shows potential. With superior Windows performance and a competitive price, we expect to see more C&T-based accelerators.

ATI GRAPHICS ULTRA PLUS

ATI GRAPHICS ULTRA PRO

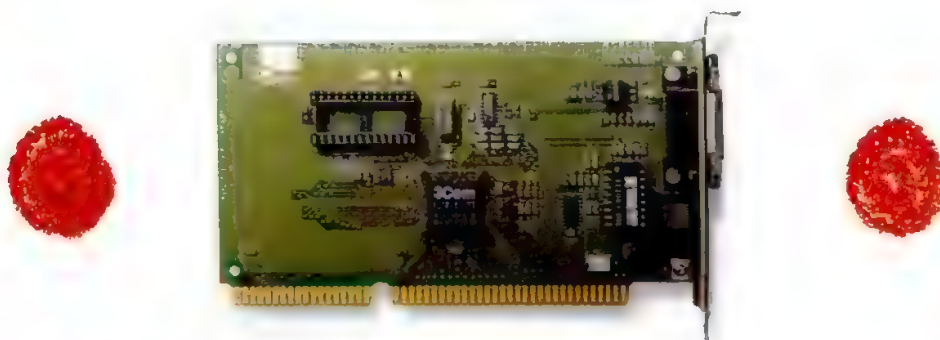
Both the ATI Graphics Ultra Plus and the ATI Graphics Ultra Pro share virtually the same physical design, save for the

type of on-board display memory: With 2MB of VRAM the Pro is priced at \$799, while the Plus, with 2MB of DRAM, lists for \$499. In addition, the Pro offers a maximum noninterlaced resolution of 1,280 by 1,024 pixels, while the Plus's display tops out at 1,280 by 1,024 interlaced.

The heart of both adapters is ATI's Mach 32 controller, a 32-bit accelerator that handles 64-bit instructions internally and includes a BitBlt engine, a 64-by-64 pixel hardware cursor, accelerated line draws, area fills, and a hardware cache.

Both of these adapters racked up impressive Windows test scores, with the Pro model pulling slightly ahead of the Plus with a Super VGA score of 6.42 megapixels per second (versus the Plus's 6.39). They also performed solidly in DOS, falling in the high side of the range for accelerator chips. The Pro model also argued for its higher price tag with quicker AutoCAD performance; however, it had some significant problems on PC Magazine Labs' test.

Using a software setup utility, the ATI Graphics Ultra Pro lets you set a linear-



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800-627-8478, 612-631-7800;
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ATI Technologies Inc.

3761 Victoria Park Ave., Scarborough,
ON, CD M1W 3S2; 416-756-0718;
fax: 416-756-0720

Cache Computers Inc.

46600 Landing Pkwy., Fremont, CA
94538; 510-226-9922; fax: 510-226-9911

Cardinal Technologies Inc.

1827 Freedom Rd., Lancaster, PA
17601; 800-233-0187, 717-293-3000;
fax: 717-293-3055

Celerite Graphics Inc.

46560 Fremont Blvd., #113, Fremont,
CA 94538; 800-472-7820, 510-226-6390;
fax: 510-226-6393

Compaq Computer Corp.

PO Box 692000, Houston, TX 77269-
2000; 800-345-1518, 713-370-0670;
no fax

Diamond Computer Systems Inc.

532 Mercury Dr., Sunnyvale, CA 94086;
408-736-2000; fax: 408-730-5750

Diamond Flower Electric Co.

135 Main Ave., Sacramento, CA 95838;
916-568-1234; fax: 916-568-1233

Edge Technology Inc.

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3045; 800-438-3343, 208-465-3434;
fax: 208-465-3424

Focus Information Systems Inc.

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Hercules Computer Technology Inc.

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fax: 510-623-1112

IOcomm International Technology

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CA 90250; 800-998-8919, 310-644-6100;
fax: 310-644-6068

Kingston Technology Corp.

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CA 92708; 800-835-6575, 714-435-2600;
fax: 714-435-2699

Matrox Electronic Systems Ltd.

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6100; fax: 510-745-8016

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fax: 512-329-6326

Orchid Technology Inc.

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Prism Imaging Systems

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Pycon Inc.

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Quickpath Systems Inc.

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fax: 510-440-7289

Sigma Designs Inc.

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fax: 510-770-2640

STB Systems Inc.

1651 N. Glenville, #210, Richardson,
TX 75081; 800-234-4334, 214-234-8750;
fax: 214-234-1306

Tangram Technology Corp.

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408-428-9165; fax: 408-435-0290

Video Seven

46305 Landing Pkwy., Fremont, CA
94538; 800-238-0101, 510-656-7800;
fax: 510-659-9285

VidTech Microsystems Inc.

1700 93rd Ln., NE, Minneapolis, MN
55449; 800-752-8033, 612-780-8033;
fax: 612-785-7963

Western Digital Corp.

8105 Irvine Center Dr., Irvine, CA
92718; 714-932-4900;
fax: 714-932-6498.

In addition to cards supplied by ven-
dors mentioned in the accelerator-
review portion of this story, we tested
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Microfield Graphics Inc.
9825 SW Sunshine Ct.
Beaverton, OR 97005
800-334-4922, 503-626-9393;
fax: 503-641-9333

Micro-Labs Inc.
7309 Campbell Rd.
Dallas, TX 75248
214-702-8654;
fax: 214-702-0655

Micronics Computers Inc.
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Fremont, CA 94539
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fax: 510-651-5612

Number Nine Computer Corp.
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800-GET-NINE, 617-674-0009;
fax: 617-674-2919

Opta Corp.
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Palo Alto, CA 94303
800-274-6782, 415-354-1120;
fax: 415-354-1144

Orchid Technology Inc.
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West Fremont, CA 94538
800-767-2443, 510-683-0300;
fax: 510-490-9312

Pixelworks Inc.
7 Park Ave.
Hudson, N.H. 03051
800-247-2476, 603-880-1322;
fax: 603-880-6558

Tseng Labs Inc.
6 Terry Dr.
Newtown, PA 18940
215-968-0502;
fax: 215-860-7713

addressed display memory space (or "memory aperture") of up to 4MB. The goal is to increase the allowable video memory address space beyond the 64K window allocated in DOS. This proved to be a significant problem. In Windows, moving windows left visible trails and displayed colors often appeared to be the reverse of what they should have been.

According to ATI, these problems are the result of the memory aperture. ATI subsequently released new software drivers for the Graphics Ultra Pro, but not in time for PC Labs' tests. The new drivers have eliminated the memory-aperture feature, choosing instead to increase the video memory space to 128K below 1MB, says ATI. The company estimates this will reduce Windows performance by about 5 percent. DOS performance should not be affected.

The Pro model ran into other problems as well. In the AutoCAD test, we found remnant pixels on the screen. The display list processor (DLP) driver should detect when new information is needed and delete old information. ATI's DLP failed to do this, however, which rendered the driver virtually useless for redraws or REGENS.

Conversely, the ATI Graphics Ultra Plus exhibited none of the problems that plagued the Pro version. The Plus model did not include the memory-aperture feature and handily navigated all of PC Labs' tests. Furthermore, Windows performance in high-color modes showed negligible degradation; the Plus turned in a Winmark test score of 5.69 megapixels per second—faster than most accelerators using only 256 colors. Though the company had not completed 24-bit color drivers in time for this review, we tested 32,768-color drivers in 800-by-600 mode on the Plus. The company estimates that a full 24-bit color driver will reduce performance to about one-fifth of full speed. Keep in mind, however, that ATI caches BitBlts, which boosts the benchmark test performance but provides a real perform-

ance boost only under certain circumstances (for an explanation of the effects of BitBlt caching, see the caption accompanying the benchmark tests).

Even without the bugs in the Graphics Ultra Pro, the Plus offers a better value for most buyers. Unless you absolutely need 1,280-by-1,024 noninterlaced resolution, the \$300 savings is worth the slight decrease in performance, and Windows users shouldn't detect any difference between the two models.

***The Graphics Ultra
Plus offers a better
value for most buyers.
The \$300 savings is
worth the slight
decrease in
performance.***

S3'S FASTEST: THE 801
Near the top of the GUI-accelerator heap are two boards based on S3's latest accelerator chip, the 86C801: the \$299 Volante Warp10 from National Design Inc. (NDI) and the \$249 PowerGraph X-24 from STB Systems. S3's 801 can de-

liver 16-bit color up to Super VGA mode and delivers full 32-bit access to display memory as well as 32-bit access to the bus interface for local bus cards (though the company offers a specific model, the 86C805, for such designs with linear addressing).

The 801 chip includes all of the features and accelerated Windows graphics calls of the older 911 and 924 controllers, as well as additional pattern-fill operations. Consequently, the NDI and STB adapters managed to lock in fourth place and fifth place, respectively, when tested in Super VGA with 256 colors. The Warp10 yielded a score of 5.70 megapixels per second and the PowerGraph X-24 delivered 5.59. Furthermore, because the 801 chip is designed to use less expensive DRAM—each adapter comes with 1MB—these two adapters represent quite a price/performance bargain.

In designing the 801 controller, S3 also improved the chip's VGA operation to further reduce wait states and included a dual-address bus for DOS text mode that allows the chip to pipeline accesses. Though these S3-based boards are still not the fastest DOS performers in this roundup, they both offer substantially better DOS throughput than their less-advanced S3 siblings.

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PC-1/83

Both of the 801-based adapters did reveal some growing pains, nonetheless. The Warp10, for example, did considerably better than the other boards we looked at on the AutoCAD test (with the exception of the TI TMS34020-based Volante AT1000, which finished just seconds ahead of it). However, NDI's Warp10 occasionally suffered from incorrectly lit pixels and missing cross hairs. STB's PowerGraph X-24 could not even complete the AutoCAD test.

WESTERN DIGITAL HOLDS ITS OWN

Of the three accelerators founded on Western Digital Corp.'s 90C31 chip—Diamond Computer Systems' SpeedSTAR 24X Graphics Adapter (\$249), Diamond Flower Electric Co.'s VG-8000WH (\$189), and Western Digital's own Paradise Accelerator Card for Windows (\$249)—only the SpeedSTAR managed to strike a good balance between DOS and Windows performance.

Proving the importance of software drivers and design, the SpeedSTAR's Winmark score of 5.06 megapixels per second ranked it seventh among the accelerated graphics adapters in Windows 256-color Super VGA performance—nearly twice the speed of Western Digital's own implementation of the 90C31 and Diamond Flower's entry. All three boards come outfitted with 1MB of DRAM, and none of them incurred any difficulties during installation.

Upon closer inspection of the Windows benchmark test scores, however, the SpeedSTAR's results were not so sparkling. The board had problems coping with Windows text-display tests, corrupting the fonts within PC Labs' Windows tests. This indicates that though Diamond's software drivers are faster than the others, the performance increase is achieved by sacrificing some compatibility and functionality.

Nevertheless, under a variety of common Windows applications, we were unable to recreate the font problems witnessed during our benchmarks tests. Unlike its two competitors, the SpeedSTAR supports 24-bit color in VGA mode, but in so doing takes an 80 percent reduction in performance relative to 256-color mode.

Although the SpeedSTAR's Windows performance put it ahead of all of the

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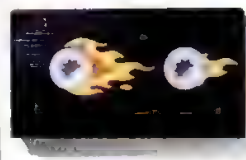
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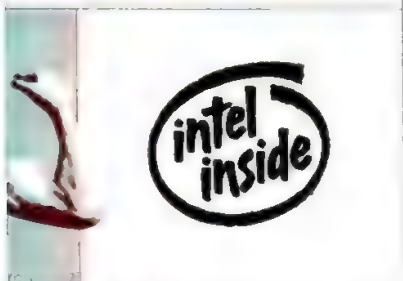
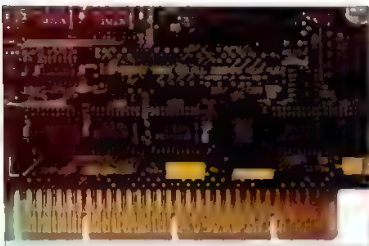


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adapters based on S3's 911 controller, it fell short on other tests. On the AutoCAD test the SpeedSTAR fell behind many of its competitors, particularly in the demanding 3-D model zoom task, though it still ranked ahead of the Diamond Flower and Western Digital designs by a considerable margin.

Both the Diamond Flower VG-8000WH and Western Digital Paradise adapters exhibited vertical-scan instability, with image flicker visible during eyes-on evaluation in 800-by-600 mode. The VG-8000WH adapter had some noticeable color shifts with 256 colors in Super VGA and 1,024-by-768 resolutions. And both boards turned in lackluster Windows performance in Super VGA—better than Compaq's QVision 1024/I, but poor compared to the majority of the graphics accelerators. AutoCAD performance didn't generate much excitement either.

The S3 Crowd

BY JOHN R. QUAIN

One of the first graphics controllers to attempt to speed up Microsoft Windows' graphics calls, S3's 86C911 has such accelerated functions as BitBlts, clipping, polygon fills, rectangle fills, and a hardware cursor. It is capable of delivering a maximum noninterlaced resolution of 1,280 by 1,024 pixels in 16 colors, though not all the boards we tested support this. S3's 86C924 is an update of the original 911 chip: The newer 924 version has all the same features and characteristics as the 911, and adds support for 24-bit color RAMDACs in VGA mode.

Again, users in search of more colors—or anticipating an onslaught of 24-bit color applications—should ensure that the manufacturer includes the necessary RAMDAC and drivers for 24-bit color support. Not all do. Though this controller can display true-color images when needed, if your work involves serious true-color image

editing, you should look elsewhere. The best 24-bit performer of the four boards with the appropriate Windows driver in this story—the \$695 Matrox Impression 1024—eked out a Winmark score of only 1.81 megapixels per second in 640-by-480 resolution.

The BIOS has been upgraded in the OEM kit for the 924 to improve DOS performance, and there have been some minor hardware adjustments to reduce wait states. The 911 and 924 controllers are pin- and driver-compatible, making it easy for vendors to upgrade their products; expect to see several manufacturers silently make the change from the 911 to the 924 chip.

In this overview, eight graphics accelerators have already made the move: Actix Systems' GraphicsEngine 1280 (\$349), Artist Graphics' WinSprint 100+ (\$495), Cardinal Technologies' VGA 900 High Color Windows Accelerator (\$349), Edge Technology's V24 BitBlaster (\$199), Metheus Corp.'s Premier 1280NI (\$399), National Design Inc.'s (NDI) Volante AT600 Plus (\$395), Orchid Technology's Fahrenheit 1280° Windows Graphics Accelerator (\$399), Quickpath Systems' Cyclone XGi (\$329), and Sigma Designs' Legend GX (\$329).

On PC Magazine Labs' Windows tests, there was very little difference between the performance of the S3 911-based boards and these newer 924-based adapters. With such factors as software driver optimization, board design, memory speed, and BIOS differences affecting performance, some more mature 911 models actually outperformed the newer 924s; all the products based on these two chips had Winmark scores in the range of 3 megapixels per second. The only excep-

tions were Artist Graphics' WinSprint 100+ and the 911-based Lynx VGA Model 336 (from Cache Computers), whose Winmark scores climbed up to 4.6 megapixels per second and 4.1 megapixels per second, respectively. Similarly, DOS throughput on these boards tended

to fall between 1,000 and 2,000 thousand operations per second, with the Premier 1280NI and the GraphicsEngine 1280 barely climbing above 2,000. Most board vendors rely on S3's own display list processor (DLP) or an available third-party driver, hence the close scores. Interestingly, AutoCAD performance proved to be somewhat of a wildcard, with no discernible pattern based on chip type (for the 911s and 924s) or DLP support.

THE GOOD 924s...

In addition to performing admirably under Windows, the well-made WinSprint 100+ boasted an easy setup routine and showed an extra measure of aplomb at a variety of Windows tasks. AutoCAD users will find it quite speedy, a bit faster than similarly configured boards.

Orchid, which has updated its original 911-based Fahrenheit 1280° to the 924 chip, includes a helpful utility to set refresh rates for each resolution, as well as a driver to support 24-bit color in VGA mode. Despite its not terribly outstanding times on the AutoCAD test, the Fahrenheit board demonstrated its maturity by breezing through all of our hands-on trials.

NDI's Volante AT600 Plus was also singled out for its responsiveness in Windows, consistent image positioning, and sharp Super VGA display. Its accompanying documentation proved helpful, and NDI's AutoCAD DLP drew notice for its anti-aliasing support in 256-color mode; excellent AutoCAD performance at a reasonable price makes this one a good bet for CAD work.

Metheus's Premier S1280NI also proved to be a solid, responsive graphics controller with good image positioning and clarity between resolutions. User's manuals were thorough and installation was easy. In addition, the Premier's AutoCAD DLP is somewhat better than the standard versions. Called AutoPlus, it includes a programmable pop-up icon keypad, a birds-eye window, and an "autopan" feature that enables you to pan around an image simply by moving the cursor to the edge of the screen.

...AND THE NOT-SO-GOOD

In addition to being one of the three boards in the story that lacked a 256-color Windows driver for 800-by-600 mode (al-

The 911 and 924 controllers are pin- and driver-compatible; expect to see several manufacturers silently make the change from the 911 to the 924 chip.



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though it rated an average 3.57 megapixels per second in 1,024-by-768 with 256 colors and a respectable 4.02 in 640-by-480 with 256 colors), Quickpath Systems' Cyclone XGi experienced some minor color shifts using its supplied 32,000-color driver and left some remnant pixels on the screen in the AutoCAD test. Sigma Designs' Legend GX revealed problems with its AutoCAD driver as well: In 256-color mode, its AutoCAD DLP failed our test, with artifacts and screen problems making it impossible to read text in this mode.

Setting up Edge Technology's V24 BitBlaster proved even more burdensome: In order to be able to jump from one resolution to another without changing jumper settings, you must initially set up the board for the highest resolution possible, then back down. It also failed to complete our VGA tests.

Cardinal's VGA 900 High Color Windows Accelerator turned in utterly average scores on the DOS and Windows tests but experienced some serious problems in hands-on testing. Of greatest con-

cern was a runtime error that caused a system lockup when we attempted to run a DOS app in a window. Its AutoCAD performance was also a bit spotty, with occasional artifact problems. The VGA 900 does earn praise, however, for providing excellent documentation.

THE ENDANGERED 911

The largest contingent of video accelerators in our roundup is based on the S3 911 accelerator chip. Nine out of the 33 graphics accelerators we tested rely on the 911 to improve Windows performance: Cache Computers' Lynx VGA Model 336 (\$395), Focus Information Systems' 2 the Max VGA GUI 6000 (\$360), IOcomm International Technology Corp.'s Michaelangelo VRAM (\$450), Matrox Electronic Systems' HiPer-VGA (\$299) and

Impression 1024 (\$695), Mylex Corp.'s Mylex GLI911 (\$360), Portacom Technologies' Eclipse II (\$294), Presenta Technologies Corp.'s Presenta Graphics Accelerator VGA (\$399), and STB Systems' Wind/X HC GUI Accelerator (\$379). Portacom also has a 924-based version of its Eclipse II; unfortunately, since it is identically packaged to the 911-based board, we were unaware of its existence until after testing had been completed.

While most list prices hover around the \$400 mark, you can find several of these boards in the direct channel for under \$300. The 911 can support up to 16-bit color in VGA mode and requires 1MB of VRAM to fully achieve all its capabilities. S3's 911 is a 16-bit chip in that its data path to display memory is only 16

While most list prices for these 911-based boards hover around the \$400 mark, you can find several of these boards in the direct channel for under \$300.

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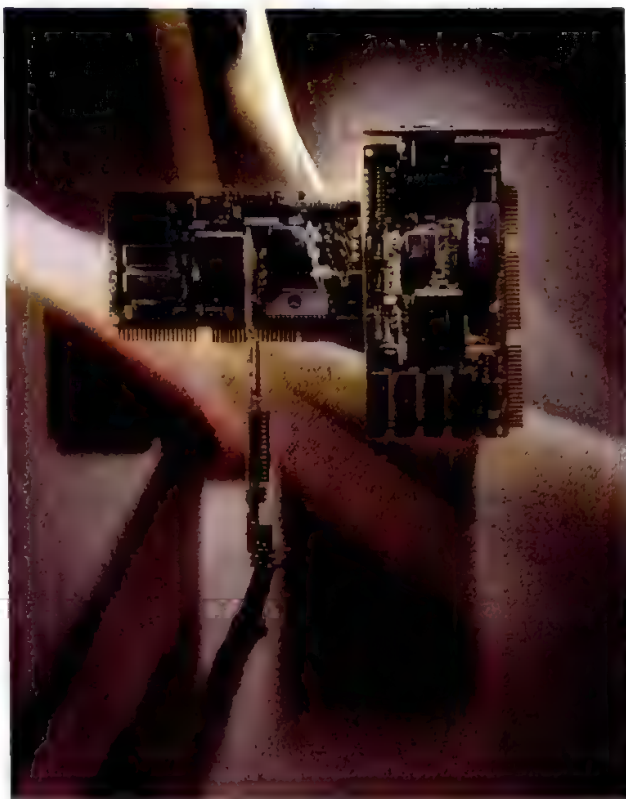
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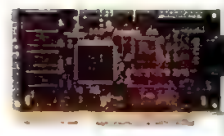


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bits wide, versus the 32-bit wide path offered by quicker graphics accelerator chips.

By and large, this group offers a similar array of features and performance margins. All except one comes with 1MB of VRAM; Matrox adds its own logic and an extra 2MB of VRAM (for a total of 3MB) to its 911-based Impression 1024 to deliver 24-bit color support. Though this group performs acceptably and unremarkably overall, there were some noteworthy problems.

STB's Wind/X HC GUI Accelerator proved to be an average performer in DOS and Windows but could not complete any of our AutoCAD test tasks. Cache Computers' Lynx VGA Model 336 proved stable and quick enough in Windows, but the supplied

owner's manual is on the skimpy side and the board requires you to change DIP switch settings in order to make scanning frequency adjustments. The Presenta Graphics Accelerator VGA performed

similarly, but suffered from crude setup software and a bit of jumpiness in its DOS display. Focus Information Systems' 2 the Max VGA GUI 6000 includes a 64,000-color VGA software driver. However, we did have difficulties properly seating the board in a standard 16-bit ISA slot.

Portacom Technologies' Eclipse II, which supports only 8-bit color, proved to be an average Windows performer and a below-par AutoCAD performer. The biggest problem with this board, though, was that its installation routine simply didn't work; we had to copy all the drivers

manually to the system directory.

Mylex Corp.'s entry, the GLI911, only managed a 60-Hz vertical refresh rate in Super VGA with 256 colors and did not include drivers for 256 colors in 1,024-by-768 mode. The board also appeared inordinately slow in accessing some GUI applications, such as CorelDRAW.

IOcomm's Michaelangelo VRAM supports a noninterlaced 1,280-by-1,024 resolution with 16 colors. But its VGA 32,768-color driver was quite sluggish and the adapter ran into driver problems on our AutoCAD test (it uses S3's DLP). It also had difficulty running DOS applications under Windows. Though Windows performance was snappy—comparable with that of the other 911-based boards—its Super VGA 256-color driver left some artifacts on the screen when scrolling text. Other complaints included a lack of proper documentation and the unique inclusion of a heat sink on the graphics controller chip—to no appreciable performance benefit.

The two Matrox boards—the HiPer VGA and the Impression 1024—turned

Note that Matrox plans to replace the 911 controller on the Impression with S3's improved 86C924 controller, which should give it a boost.



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in the lowest Winmark test scores of any S3-based board in 256-color Super VGA mode (3.29 megapixels per second and 3.32 megapixels per second). The Impression 1024, however, outperforms the other 24-bit-capable boards in true color Super VGA mode. Users should find it reasonable for the occasional display of true-color bitmaps. Its installation process is smooth and performance under various GUI conditions is unswerving. If the \$695 price tag doesn't put you off, note that Matrox plans to replace the 911 controller on the Impression with S3's improved 86C924 controller, which should give it a boost.

THE TAIL OF THE COMET

One big disappointment in this roundup proves to be Compaq Computer Corp.'s QVision 1024/I, the ISA version of the PC manufacturer's original EISA video adapter. Priced at \$375, the adapter uses a proprietary controller from Compaq along with 1MB of DRAM. In the past, the EISA version of the QVision adapter did extremely well in PC Labs' Windows benchmark tests.

Subjected to the new suite of tests from Winbench 3.1, however, the QVision's weaknesses quickly became apparent. Compaq's QVision Controller only accelerates raster operations, BitBlt, and line draws. PC Labs' latest Windows benchmark tests, in addition to including a new weighting system, have some additions that particularly hurt the QVision's scores, including text handling tests and the repositioning of line draws. Consequently, the QVision fared rather poorly on the new suite of Windows tests, turning in a Winmark score of only 2.34 megapixels per second in Super VGA with 256 colors. This put the QVision only slightly above the bottom performers in this roundup and far below the accelerated boards based on the S3 controllers.

AutoCAD test results were only marginally better, though Compaq's graphics adapter clearly superseded the poorer Windows performers in handling AutoCAD tasks. Where the QVision reveals its strengths is in its ease of use and features. The adapter can display noninterlaced resolutions up to 1,024-by-768 pixels with 256 colors at a 72-Hz vertical refresh rate, as well as 16.8 million colors

in 640-by-480 mode; 24-bit Windows 3.1 drivers were not available for testing, however. The board conducted itself well on some difficult Windows and DOS switching tasks, and setting up the adapter was painless.

But these points should not surprise users, considering the adapter was originally designed to work in our test-bed: a Compaq PC.

Another inexpensive adapter—and also near the bottom of our performance curve—is the Video Seven WIN.VGA. Based on the Headland Technologies HT216 graphics accelerator, the \$159 adapter comes with 1MB of DRAM and includes a straightforward installation routine. The WIN.VGA performed about on a par with the VidTech entry—pretty slow—but handles most tasks with

aplomb. The one exception was Video Seven's 1,024-by-768 Windows driver with 16 colors. It could not complete our Windows tests in this mode, although the same resolution with 256 colors ran without incident.

The two accelerators based on Avance Logic's 2101 controller, the \$149 Prism Accelerator X-VGA from Prism Imaging Systems and the \$145 TANXcell-GUI from Tangram Technology, turned in similarly poor Graphics Winmark test results, despite the fact that the 2101 counts line draws, BitBlt, and a

hardware cursor among its accelerated functions.

Although the Prism Accelerator X-VGA can display 256 colors in Super VGA with a 72-Hz vertical refresh rate, it drops down to a 56-Hz vertical refresh

In the past, the QVision adapter did extremely well in PC Labs' tests. Subjected to the new suite of tests, however, its weaknesses quickly became apparent.

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rate to display 64,000 colors. It handled most tests without complaint, but we were unable to run our AutoCAD tests because of a display list overflow caused by the Prism driver.

The Tangram design offers features identical to that of the Prism offering and didn't fair much better than its chip relative. The TANXcell managed to complete the AutoCAD test but in an unimpressive fashion. Its strongest point was problem-free installation. Both adapters—though appearing less than stable in rigorous Windows use—managed standard Windows tasks without much difficulty.

Near the bottom of the graphics acceleration ladder are two products that rely on the Weitek 5186 chip. The \$299 Vid-Tech Microsystems WinMax, with 1MB of VRAM, turned in unimpressive Windows performance (a Winmark score of 2.1 megapixels per second). But it did run through the barrage of application tests without incident and produced 32,768 colors in VGA mode. Since it has only 512K of DRAM, the \$149 Kingston Technology Corp. View Rx turned in abysmal Windows performance in its one 256-color mode—1.41 megapixels per second in 640-by-480 resolution. These boards also coupled their tardy Windows scores with the two slowest overall AutoCAD times.

Another entry that landed in the bottom of group was Celerite Graphics' \$139 Galaxy 2000. Based on a Primus P2000 graphics controller and equipped with 1MB of DRAM, the Galaxy 2000 is unique in our review group. The least expensive adapter in this roundup, the Galaxy 2000's controller is a limited accelerator, as our tests demonstrate. Offering only accelerated BitBlts and limited area-fill functions, it does not improve the speed of line draws, font displays, or other commonly accelerated functions.

Consequently, it turned in the worst Winmark score in Super VGA mode, and although it supports up to 16.8 million colors in VGA, performance at such color depths is snail-like. Its AutoCAD performance is middle-of-the-pack overall, but the Galaxy 2000 offers some helpful AutoCAD utilities. Despite the attractive price, its poor performance should dissuade most users from considering the Galaxy 2000.

Coprocessed Boards

BY ROCK MILLER

Boards based on Texas Instruments' TMS340x0 series of general-purpose graphics coprocessors are rare in the under-\$1,000 price range. We reviewed four. National Design Inc.'s (NDI) Volante AT1000, a TMS34020-based adapter, comes in just under the wire at \$995. Three TMS34010-based adapters from Hercules Computer Systems also made the cut: the pass-through Graphics Station Gold 16+2 (\$579) and Graphics Station Gold 24+2 (\$679), and the \$699 Graphics Station Card GB1024+2, which has on-board VGA. As we discovered during testing, these coprocessed designs can't match their simpler and cheaper ac-

*These coprocessed designs
can't match their cheaper
accelerated counterparts on
a price/performance basis,
but there are strategic and
technical reasons for
considering these boards.*

celerated counterparts on a price/performance basis, at least in ordinary use under Microsoft Windows. There are strategic and technical reasons for considering these coprocessed boards, however, particularly for CAD applications.

Arc and ellipse operations, for instance, are not built into fixed-function accelerator chips. The coprocessor's general-purpose nature also makes it possible to do more complicated things with specific applications. The image-editing program PixaFoto (from PixaArts Corp.), for example, takes advantage of the TI chip by off-loading time-consuming bitmap transformations to the board. Above all, the TIGA standard—a driver API for TI-based boards—has the advantage of being widely supported: For some non-Windows graphics applications, especially custom applications, one

of these adapters may be your only option for getting extra performance at a reasonable price.

VOLANTE AT1000

This former Editors' Choice winner turns in good Windows performance and the best total AutoCAD score in the bunch. But considering its \$995 price and its powerful TMS34020 processor, it had better. Given that some of the boards based on the S3 chip do almost as well at a fraction of its price, the extra increment of performance that the AT1000 offers won't be worth the freight to many users, especially Windows users. But if you do need the TI processor, you'll find this adapter to be well supported and a decent bargain.

The board itself is rough in its physical construction and achieves only a Class A FCC rating, but we had no particular trouble slotting or installing it and it functioned reliably in our tests. Its high-quality Tseng ET4000AX VGA chip set (with NDI's own BIOS) gives it good VGA performance. There's even a place on the board for a TI numeric coprocessor, though this must be installed at the factory. A \$795 pass-through version, the AT800, is also available.

Configuring the TIGA software (a TSR that takes up 40K of RAM) and the various Windows and AutoCAD drivers was rather easy. In our testing, monitor flicker was minimal, and the custom screen positioning and scaling utility proved to be easy to use; it fitted the image to the monitor reliably in all the supported resolutions.

The Volante AT1000's Winmark performance is no better than that of the top-performing, less-expensive entries from ATI and Pycon, but the Volante does significantly outstrip most S3-based boards. Its real strength, though, is as a CAD engine. Its SoftEngine 386 display list processor (DLP) driver—the same one included with NDI's S3-based boards—runs exceptionally quickly and is notable for its support of true display list editing (in which deleted objects are removed from the display list in the background) and anti-aliasing using the board's 256-color display to eliminate jaggies on lines. It has a birds-eye pan window and also allows you to create your own pop-up programmable keypads. Our test version

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Business meetings often find themselves called upon to take care of important details while visiting the client's office. When that occurs, it's best to have immediate access to an office computer as possible. It's also that computer at your home office is familiar enough with your personal files that they can quickly find anything you need. A portable computer can be a highly effective way to make a handful of files in a compact case that can be accessed from the business office.

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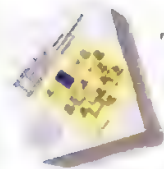
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CIRCLE 066 ON READER SERVICE CARD

of the adapter lacked support for high-color rendering, which may be a detraction for AutoShade and Autodesk 3D Studio users. However, NDI stated that it was in the process of shifting to a 24-bit AT&T DAC, so by the time you read this, the board should support a full complement of 16.8 million colors.

GRAPHICS STATION SERIES

The TMS34010-based Graphics Station offerings from Hercules actually encompass two sets of designs. The original Graphics Station GB1024+2 is still on the market at \$699 for our test configuration of 1MB VRAM with 2MB DRAM (\$599 for a VRAM-only model, the GB1024). But it has been supplemented by the newer Graphics Station Gold cards, which are a bit less expensive and which support higher scanning frequencies (up to 75 Hz in the important resolutions) for more stable displays with the new generation of high-frequency monitors. The Gold 16+2 has a 15-bit RAMDAC and comes with 2MB of DRAM in addition to the standard configuration of 1MB of VRAM and costs \$579 (\$399 with VRAM only). The Gold 24+2, on the other hand, offers true 24-bit color, 1MB of VRAM and 2MB of DRAM, and costs \$679 (or \$499 with VRAM only). The 1MB of VRAM, which is standard on all three boards, is sufficient for all supported modes; DRAM is used for TIGA program storage, font caching under Windows, and display list storage under AutoCAD. The GB1024+2, however, comes with a garden-variety Intel VGA chip set on board, while both Gold series cards are pass-through designs that require an external VGA card.

The Hercules-written AutoCAD driver is a notable asset: With it, all three Hercules cards deliver excellent display list performance equal to the best of the S3-based cards, and with exceptional redraw scores. For additional convenience, the AutoCAD driver offers a "Spyglass" magnifier window as well as a birds-eye global-view pan window, and the Hercules cards are among the few that offer Animator Pro drivers in addition to AutoShade and 3D Studio drivers.

Windows users, however, will find the Hercules boards promise a lot more than they deliver. All turn in lackluster performance (Winmark scores in the range

of two megapixels per second across all resolutions at 256 colors) in comparison with their cheaper accelerated brethren. Indeed, on some of the most important operations—BitBlts, rectangles, pattern fills, and scrolled text—the throughput of the Hercules cards falls far short of that of the rest of the cards in this article. True, there are a few bright spots in the Windows performance picture: the ability to cache TrueType fonts in card-based DRAM gives all three good scores on the Mixed Text scrolling tasks, for instance. On the other hand, our testing did flush out some compatibility problems: The 256-color TIGA driver locked up the system while zooming a bitmap in Aldus PhotoStyler, and the high-color driver locked up our test of 32-bit VGA moves running within a DOS window.

Though the Gold 24+2 and GB1024+2 support true-color operation (at non-PC standard resolutions of 512-by-512 and 512-by-480), there are no Windows drivers for these true-color modes. Thus, if Windows is your game, there is little reason to choose the Gold 24+2 over the less expensive Gold 16+2; both support a maximum of 32K colors at 640-by-480 resolution under Windows and are nearly identical in performance. (The Gold 24+2 does support higher scan frequencies at 1024-by-768 resolution, up to 76 Hz as opposed to 71 Hz for the Gold 16+2, and both Gold cards produce a noticeably more stable image than the GB1024+2.)

Getting a full-sized, stable screen image can be more trouble than it would seem. In some resolutions, the screen image doesn't come close to covering the full screen area; although the ambitious Monitrac software lets you fine-tune scan frequencies and screen-image dimensions, the incremental adjustments that it allows aren't always enough to do the job, and one can easily lose sync by trying to expand the screen image past the narrow adjustment boundaries. In some cases, the only way we could get the image to cover the full screen area was to shift to a lower monitor frequency setting.

The Hercules cards are acceptable for AutoCAD use, and they can be a good low-cost choice for those who must have a TIGA board. But the TI TMS34010-based technology on which they are based simply doesn't keep up with the competition in the Windows area. □

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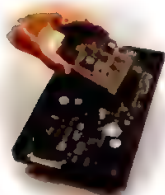
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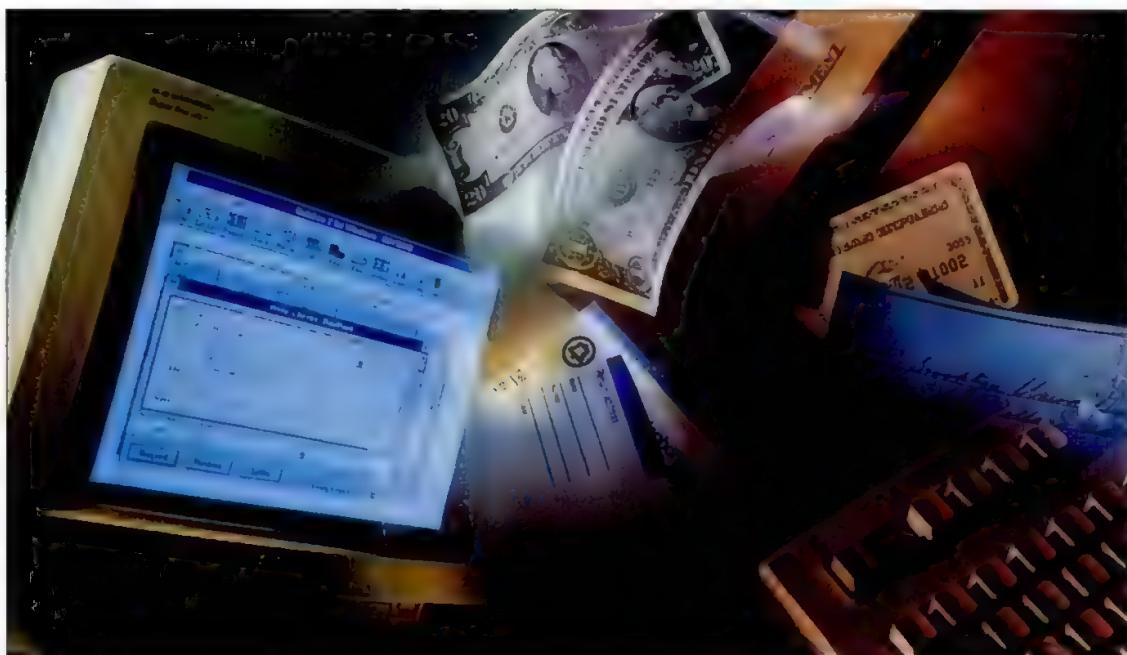
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CIRCLE 231 ON READER SERVICE CARD

Tracking Dollars With Sense



Put away your eraser, eyeshade, and pocket calculator and let one of these nine personal finance managers take the guesswork out of money management.

The mere mention of personal finance management brings looks of guilt and embarrassment to so many faces. Mind you, many of these faces belong to bright, well-paid professionals, but their typical gut-level grasp of financial planning is something like "Everything's okay as long as I don't bounce a check." For people like these, the monthly bank statement is little more than potential reference material that's ea-

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by Chris Shipley

Personal Finance Managers

sier to store if it hasn't been opened. For them, paying bills is an onerous chore: writing checks, entering check amounts in the register, doing the math—none of it's any fun.

Yet many of these people think about money a lot. They wonder how much they need to save to send their kids to college or to take a vacation in France. They worry about how hard they'll be hit by taxes this year. And as they get older, they ponder what sort of retirement they'll be able to manage. The problem is, they rarely get beyond the wondering, worrying, or pondering stage.

HELP'S ON THE WAY

Personal finance management software can liberate people like these from much of their guilt and their worry. It can also save them time and often money. Better yet, there's little learning involved: Our nine review packages—Balance Point 1.1a, CheckFree 3.0, "Cheque-It-Out" 2.0 (a Windows version of "Cheque-It-Out" was not ready in time for our review, but it is shipping now), Managing Your Money 9.0, Microsoft Money 2.0, MoneyCounts 7.0, Quicken for DOS 6.0, Quicken for Windows 2.0, and WinCheck 3.0p—all use a simple checkbook metaphor where information entered in an on-screen check is automatically transferred

to the check register (or vice versa). When all transactions are entered, the program prints the checks and the information becomes part of a permanent, detailed record-keeping scheme that lets you see exactly how you're spending your money by way of charts or diagrams. Some packages go further, providing links to electronic bill-paying services that pretty much eliminate check writing altogether.

A good personal finance manager helps by eliminating the drudgery of repetitive data entry and providing insight into your financial situation. Moreover, most of these programs also dispense useful advice about how to handle your money wisely.

Your accounts are more accurate, too. The software records and tallies every transaction. When it's time to reconcile accounts, you enter the opening and closing amounts from the statement, then check off items that have cleared the bank. In a matter of minutes, your checkbook is in balance.

The programs we reviewed are all reliable, and most include a backup reminder and utility to reduce the likeli-

hood of your ever losing important data. At any time, you can print a copy of your check register, plus handfulls of other useful reports, giving you a paper-based record of your accounts.

FEATURES PLUS

Join author Chris Shipley and representatives from Intuit and MECA Software in ZiffNet's Executives Online Forum for a discussion of personal finance software, from Monday, January 4, to Friday, January 8. You can follow the action by typing GO ZNT:EXEC at any CompuServe prompt.

FAST AND SMART

Of course, a faster, more accurate replacement for a manual operation is interesting only up to a point. It's what these programs do with the data they collect that really makes personal finance managers a smart investment. For example, many personal finance management programs help you remember when it's time to pay recurring bills, such as mortgage or car payments, by displaying on-screen reminders, thereby eliminating late fees and interest charges.

Further, they let you track your cash flow by budget category—in most cases simply by making a menu selection when you write a check or record a deposit. As these records accumulate, you can quickly see where your money is coming from and

where it's going. If you're willing to invest a bit of time in planning, you can use these packages to build a detailed budget,

Suitability to Task:

Personal Finance Managers

Personal finance managers should make money management faster and easier while providing insight into your financial situation. These Suitability to Task ratings compare personal finance managers on their ability to handle the most common money-management chores quickly and easily. They also evaluate the level of information analysis you can glean from the data you have collected.

Checkbook management is the core of every personal finance manager. In order to receive an *excellent* rating, a program should assist users in setting up their accounts. It should fully automate the process of writing and recording income and expenses, remembering recurring transactions and handling many of the data-entry chores. The program should also assist in account reconciliation and allow users

to edit and add transactions from within the reconciliation module.

A good finance manager also helps you watch where your money is going. **Budgeting** features—such as sorting income and expenses by category, setting spending and earnings objectives, and providing detailed reports—can provide tremendous insight into your finances. A good budgeting module can help you spot unusual spikes in your spending and find places ripe for cutting.

Once you have collected all this data, it is good to have help with **tax and financial planning**. The better finance managers help you figure out your tax liability throughout the year, enabling you to take action to reduce your tax burden. The programs should also help you make smart decisions about loans and savings plans.

The logical extension of checkbook management is **portfolio management**. Not all personal finance

SUITABILITY TO TASK

Product Name

	POOR	FAIR	GOOD	EXCELLENT
Checkbook management	●	○	○	○
Budgeting	●	●	○	○
Tax and financial planning	●	●	●	○
Portfolio management	●	●	●	●
Electronic connections	N/A			

N/A—Not applicable: The product does not perform this task.

managers offer portfolio-tracking capabilities. The packages that do offer them provide users with a wide range of support, from the mere recording of investment purchases and sales to pinpointing investments that should be sold.

Electronic connections to bill-paying services or on-line stock quotes can keep you on time with payments and up-to-date on prices. Only a few personal finance management programs offer these beneficial features.



EDITORS' CHOICE

- **Managing Your Money**
- **Quicken for DOS**
- **Quicken for Windows**

both to set spending targets and to see how your cash flow changes monthly. The combination of a budget and a cash flow report can help you plan ahead to meet your regular payments when times are leaner.

TAX SAVVY

A good finance manager can also provide guidance in reducing your tax liability by monitoring your income, tax payments, and deductible expenses. In a matter of minutes, you can run a tax summary report to see if you're withholding enough—or too much—from your paycheck. Managing Your Money goes so far as to provide a Form 1040 Report that calculates the amount of tax you owe or refund due, based on the previous year's tax tables. Some programs even let you do "what if" analyses on specific tax-related financial decisions: Does it, for example, make good tax sense to invest in home office equipment now or to make a charitable contribution in December that you may have originally planned for January? In this way, you can eliminate surprises come April 15.

HOW WE TESTED

We put our nine personal finance managers through their paces to see how well each would meet the needs of the average user and how quickly a new user could learn the ins and outs of the program and begin handling everyday financial management chores. Our tests focused first on checkbook management and budgeting, as we set up checking, savings, and money market accounts in each program. We tested the programs' prowess in automating repetitive data entry and the ease with which we could reconcile accounts from month to month.

We also set up accounts for credit card and mortgage loan tracking to test the links between these accounts and the checkbook. We established budget categories to monitor common household expenses, and income and expenses in various tax categories (which was simple, since most packages provide prepared

It was easy to spot the contenders for Editors' Choice. Quicken, in both its flavors, and Managing Your Money stand head and shoulders above the

field of personal finance management programs as the most complete finance managers reviewed here. These programs are packed with features to help you track and plan your money matters, while at the same time retaining an ease of use that is unsurpassed by any other package.

But choosing which one of these is truly the best is a much harder matter. Intuit's Quicken is the uncontested ease-of-use champion in this category. In both the DOS and Windows versions, Quicken makes paying bills not just easy, but easier than doing the same task by hand. Along the way, you get much more information than you would if you were to do the task manually. Quicken tracks your budgets and feeds back detailed text and graphic reports. If automating a tiresome chore weren't enough, Quicken integrates financial data from a variety of sources, giving you more insight into—and as a result, more control over—your finances. The new Intelli-Charge VISA card sorts your card purchases into budget categories and feeds this data to Quicken via modem, making budget tracking a no-brainer for users.

We would recommend Quicken to many of our friends (a risky business when you know you're going to be stuck listening to their complaints if they don't like it and playing pseudo technical support if they can't use it). On both counts, we are confident that Quicken will suit their needs and be so easy for them to use that we'll hear nary a word from them after the initial "Gee, thanks. It's great!"

We have a few friends, though, who have financial record-keeping needs that push at the limits of Quicken's capabilities. These are the ones who re-

ceive *The Wall Street Journal* at home and get nice gifts from their brokers on the holidays. They are active investors for whom a burp of the stock market can mean significant gains or losses. We tell these friends to use MECA Software's Managing Your Money.

Managing Your Money provides the same level of support for general banking and budgeting tasks, including—like Quicken—integrated access to CheckFree, an electronic bill-paying service. But unlike Quicken, Managing Your Money offers unsurpassed support for investors. Its portfolio manager is sophisticated and complete. Beyond a repository for buy and sell transactions, Managing Your Money's portfolio manager tracks investments by tax lots and recommends investments to sell in order to reduce your tax burden.

With Managing Your Money, prices in your portfolio can be updated manually or automatically by dialing into Dow Jones News/Retrieval or CompuServe. If prices climb to a target sell price or slip to a stop-loss price, Managing Your Money can alert you with an on-screen, printed, or faxed message, or contact you via a SkyTel pager.

Those who feel they are unlikely ever to plumb the full depth of the features offered by our Editors' Choices might want to take a look at Microsoft Corp.'s Microsoft Money, Version 2.0, which impressed us as an attractive and particularly easy-to-learn basic checkbook package. They should not necessarily expect to save money in opting for the simpler product, however: Microsoft Money and Quicken carry the same list price; street pricing is variable.

Our Contributors: CHRIS SHIPLEY is executive editor of ZiffNet and a contributing writer to Ziff-Davis publications.

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Practical Peripherals/Delrina Technology

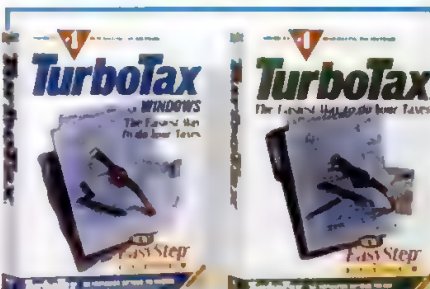
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6700	▣Automap Europe..... 79.
Avery Dennison	
6006	▣Label Pro 1.6 (Laser)..... 49.
Banner Blue Software	
3322	▣Family Tree Maker 2.0..... 39.
2088	▣Org Plus 1.0 for Windows..... 125.
Berkeley Systems	
9885	▣After Dark 2.0 for Windows..... 29.
6649	Star Trek: The Screen Saver (3½" only) 34.
Bitstream	
8040	Bitstream Li'l Bits (3½" only)ea. 19.
6066	▣FaceLift 1.5 for WordPerfect 5.0/5.1.... 69.
2089	▣TrueType Font Pack 1 for Windows 3.1 52.
	▣MakeUp 1.0 for Windows 3.0/3.1 99.
Borland International	
9635	□Object Vision 2.1 99.
3379	□Quattro Pro WinDOS (Windows & DOS) 299.
1514	□Paradox 4.0 529.

Broderbund	
1434	▣New Print Shop 3.0..... 35.
5900	▣PC USA 2.0 29. 5902 ▣PC Globe 5.0 39.
8855	□Print Shop Deluxe 1.0..... 45.
ButtonWare	
6419	▣PC-File 6.5..... 85.
Caere	
4130	▣Faxmaster 1.0..... 159.
6568	▣OmniPage Direct 1.0..... 259.
8933	▣OmniPage Professional 2.1 629.
Calera	
1769	▣Fax Grabber 1.2 55.
1953	▣WordScan Plus 1.1 429.
Central Point	
5039	□PC Tools 8.0..... 125.
9751	▣AntiVirus 1.4 89.
8114	▣Backup 7.1 (DOS and Windows)..... 89.
ChipSoft	
1663	▣Turbo Tax Personal 1040 for DOS 49.
3517	▣Turbo Tax Personal 1040 for Windows... 49.
6221	▣Turbo Tax/Quicken Bundle 10.0/6.0 Headstart version 59.
3080	▣Turbo Tax Windows/Quicken Bundle 10.0/6.0 59.
	▣Turbo Tax State Packages for DOS..ea. 39.
Claris Corp.	
5257	▣FileMaker Pro for Windows 268.
5228	▣FileMaker Pro Competitive Upgrade ... 95.
CompuServe	
7546	▣DOS Membership Kit 2.0..... 25.
Computer Associates	
5779	ACCPAC Simply Accounting 1.0 for Windows (3½" only)..... 119.



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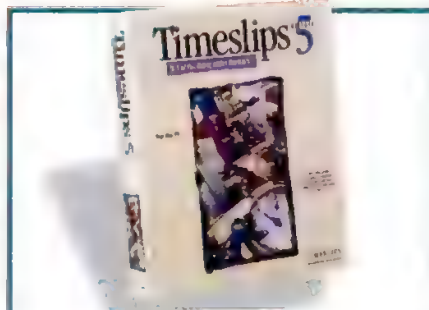
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1852 ☐ 1-2-3 **2.4 Upgrade**..... **99.**

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3627 ☐ **Windows Draw! 3.0**..... **99.**

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8579 ☐ **MoreFonts 3.0**..... **75.**

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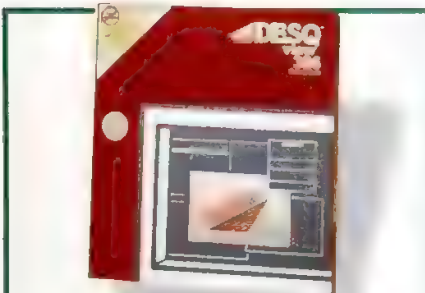
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- 5883 FaxWorks 2.5 (3 1/4" only) Windows & DOS 65.
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 4403 □Harvard Graphics 1.0 for Windows.... 369.
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Symantec
 3784 □The Norton Backup 2.0 for Windows... 99.
 3146 □The Norton Utilities 6.0 115.
 7999 □Norton Anti-Virus 2.1 84.
 2359 □The Norton Desktop 2.0 for Windows 115.
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 1220 □FASTAT 2.0 for DOS 399.
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 6210 □Stanford Graphics 2.0 for Windows... 359.
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T/Maker
 6027 □Fax Mania DOS or 7911 Windows ea. 27.
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 7420 □Check It Plus 3.0 85.
Traveling Software
 4407 □LapLink Pro 4.0 99.
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 3804 □WordPerfect 269. 3494 □for Windows .279.
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 8351 □Heaven and Earth 1.0..... 29.
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 3340 □Kid Pix 1.0 35.
 5851 □SimCity 1.0 from Maxis 29.
 4411 □SimEarth 1.0 for Windows from Maxis 45.
Davidson & Associates
 3947 □Math Blaster Plus 29.
 7727 □Kid Works 2 35.
Edmark
 7477 □Kid Desk 1.0 26.
Great Wave Software
 8390 □NumberMaze 1.0 - DOS 25.
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 □Word Torture for Windows ea. 34.
 □Word Torture 3.0 ea. 29.
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 8653 □Mario Teaches Typing 24.
 4692 □Dvorak on Typing for Windows 29.

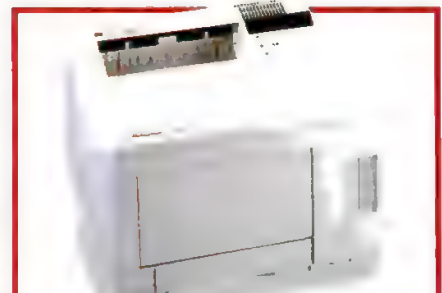


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5770 Sound Blaster 16—16-bit CD-quality stereo sound. Includes stereo digital/analog mixer, built-in power amplifier, MIDI and CD-ROM interfaces **\$229.**

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- 6456 □Isaac Asimov's Science Adventure 49.
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 4909 □Batman 39.
 5095 □Teen. Mutant Ninja - Manhattan Mission 29.
Microsoft
 5514 □Entertainment Pack 4 29.
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 8492 □Golf for Windows 45.
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 □VocabuLearn/vce Levels I & II (French, Italian, German, Spanish, Russian, Hebrew and Japanese) ea. 35.
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Sierra On-Line ... CP
 8591 □Quest for Glory III 39.
 5150 □Aces of the Pacific 45.
 5338 □King's Quest 6 45.
Software Marketing Corporation
 5147 □Orbits 1.0 39.
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Software Toolworks
 4534 □Mavis Beacon Teaches Typing 2.0 (CP) 29.
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 3032 □ChessMaster 3000 for Windows 35.
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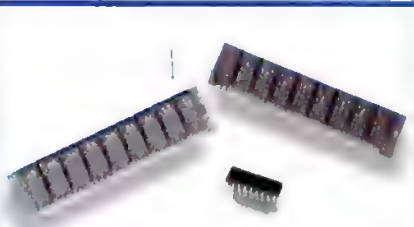
- 8444 □Carriers at War 39.
Toyo
 5138 □Go Master Deluxe 5.0 for Windows 99.
 5143 □Go Master Deluxe 5.0 99.
Walt Disney Computer Software
 1162 □Mickey & Friends Fun Pack 1.0 23.
 2629 □Mickey's 123's or 2624 ABC's ea. 29.
 9984 □The Animation Studio 1.0 72.

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Warranties listed next to manufacturer.

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 3453 EtherLink II/16... 159. 3469 II/16 TP.. 169.
American Power ... 2 years
 7108 Smart UPS 400 339. 7105 UPS 600 439.
 3819 Back-UPS 250. 115. 3858 UPS 400 . 179.
 7107 Back-UPS 450. 215. 3823 UPS 600 . 295.
Appoint ... limited lifetime
 2469 Thumbelina PC or 2480 MousePen Pro PC 62.
ATI Technologies ... 5 years
 9985 VGA Integra (1024 x 768, 16 colors)..... 84.
 8463 VGA Wonder XL24 (with 1 MB)..... 149.
 3886 Graphics Ultra + (with 2 MB)..... 339.
 3871 Graphics Ultra Pro (with 2 MB)..... 519.
 2382 Graphics Vantage VGA (with 1 MB)..... 225.
 3902 StereoFX (sound board) 109.
Boca Research ... 5 years
 7150 BOCARAM/AT PLUS (2 MB) 209.
 7139 (4 MB) 319. 7138 (8 MB) 539.
 8398 External 14,400 Baud V.32 FaxModem 275.
 8397 Internal 14,400 Baud V.32 FaxModem 219.
 6998 I/O Board for AT 49. 6999 for PS/2 89.
 8380 BasicVGA 49. 8381 SuperVGA 115.
Bravo Communications ... 2 years
 7400 2 Position Laser Compatible Switch Box 109.
 7501 CPS1021 (electronic switch box)..... 135.
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Canon ... 1 year
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 7809 BJ200 Printer 369.
 8940 BJ-C800 Color BubbleJet Printer 1899.
 7897 BubbleJet Ink Cartridge (BJ-10ex) 23.
Cardinal ... 1 year
 8690 MVP24I Modem Value Pack 39.
 7667 MVP96IF FaxModem Value Pack 195.
 8689 386SX-33 MHz Motherboard OK 275.
Chips & Technologies ... lifetime
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 6138 387DX-33..... 65. 8388 387SX-33 84.
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COVOX ... 1 year
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- 2497 4 MB x 9 SIMMs (80 ns)..... call
- 5746 1 MB Chips (80 ns, set of 9)..... call

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- 8578 Sound Blaster..... 99.
- 2336 Sound Blaster Pro..... 189.
- 5770 Sound Blaster 16..... 229.

Curtis ... lifetime

- 1708 Ruby-Plus SPF-2+..... 59.
- 7358 Command Center SPF-4..... 79.

Cyrix Corporation ... 5 years

MATH COPROCESSORS

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- 9875 FasMath 83D87-25 or 9876 83D87-33 ea. 89.

Diamond Computer ... 5 years

- 8333 SpeedStar 24X Graphics Accelerator .. 175.
- 6945 Stealth Hi-Color..... 239.

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- 7103 FX-870 (80 col., 380 cps, 9 pin)..... 319.
- 7153 FX-1170 (136 col., 380 cps, 9 pin)..... 409.
- 2358 LQ-570 (80 col., 252 cps)..... 289.
- 2361 LQ-870 (80 col., 330 cps)..... 489.
- 2357 LQ-1170 (136 col., 330 cps)..... 669.

Hauppauge Computer ... 1 year

- 4008 Win/TV..... 439.

Hayes ... 2 years

- 9039 Accura 2400 external.. 85. 9033 int..... 79.
- 7391 ULTRA 96 Modem..... 599.
- 5024 ULTRA 144 Modem..... 669.
- 1345 OPTIMA 24 Modem..... 125.
- 3522 OPTIMA 96 Modem..... 349.
- 8187 OPTIMA 24+FAX96..... 159.
- 7395 OPTIMA 144+FAX144..... 479.
- 9884 Pocket Edition 2400..... 119.

Hewlett-Packard ... 1 year

- 7620 DeskJet 550C (color) (with ink cart.).... 789.
- 7621 DeskJet Portable (with ink cartridge).... 439.
- 3957 LaserJet IIP Plus (with toner)..... 879.
- 6442 LaserJet 4 (with toner)..... 1499.

Intel ... 3 years

- 3864 14.4EX Modem..... 469.
- 1086 Matched Memory Classic Memory Brd. Ok.. 95.
- 5992 SatisFAXtion Modem 200..... 299.
- 5994 Modem 400. 399. 5995 Modem 400E. 449.
- 5999 FAXability Plus (software)..... 79.
- 6003 FAXability Plus OCR (software)..... 165.
- 2994 EtherExpress 16 or 3021 16 TP ea. 129.
- 6418 OverDrive Processor (for 486SX-25 MHz) 499.
- 8943 OverDrive Processor (for 80486DX-33).... 669.

- 4750 80387SX (all 80386SX CPU's)..... 79.
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- 2582 Master Piece Plus 95. 2587 Remote 105.
- 7899 Expert Mouse serial... 99. 7900 bus... 115.
- 3311 MasterStand..... 59.

Key Tronic ... 3 years

- 4518 101 Plus Keyboard..... 99.
- 4387 Trak 101 Keyboard (with trackball)..... 165.

KOSS Corporation ... lifetime

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- 5459 HD-4 speakers with equalizer..... 49.

Logitech ... limited lifetime

- 3996 Trackman2 (combo)..... 84.
- 2343 Trackman Portable..... 99.
- 7975 ScanMan 256..... 269.
- 1015 ScanMan Color..... 599.
- 3295 MouseMan (combo) 89. 9766 (cordless) 89.

MediaVision ... 3 years

- 5637 ProAudio Spectrum 16..... 199.
- 8404 Thunder & Lightning..... 219.
- 7873 Fusion CD 16..... 499.
- 5638 MultiMedia PC Upgrade Kit 16..... 969.
- 6829 CDPC (CD, ProAudio 16 & speakers).. 999.



Intel ... 3 years

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- 2898 Mouse with Windows 3.0 (bus or serial) 149.
- 1896 Ballpoint Mouse (serial only)..... 119.

MicroSpeed ... 1 year

- 6007 PC-TRAC Trackball serial..... 75.

Microtek ... 1 year

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- 5175 ScanMaker IIXE..... 1099.

Mouse Systems ... lifetime

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- 7878 PC Mouse III (serial)..... 69.
- 5427 NewMouse..... 62.
- 5979 NewPoint..... 62.
- 5978 PenMate..... 209.

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- 7778 PrintScan 105..... 179.
- 8450 Color Artist for Windows..... 319.
- 7780 Color Artist Pro..... 399.
- 8455 6000C Color Scanner for Windows..... 999.

NEC ... 2 years

- 4252 MultiSync 3FGX Monitor (14")..... 689.
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- 9590 OL810 Page Printer..... 1089.
- 5094 OL830 Page Printer (8 ppm)..... 1299.
- 3025 Toner Cartridge..... 25.

Orchid Technologies ... 4 years

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- 2 MB..... 119. 7759 4 MB..... 199.
- 7959 4 MB Upgrade for LaserJet 4..... call
- 5729 ProTracer (personal CAD printer) (1 yr.) 1099.

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- 7915 Turbo Cool 300..... 159.



Video Seven ... 7 years

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8132	PM2400 Pocket Modem.....	109.
5435	PM2400F (internal).....	59.
5437	PM2400F Pocket Modem.....	115.
5429	PM2400EFX SAV.42 bis (external).....	145.
5428	PM2400EFX V.42 bis (internal).....	139.
5436	PM2400F SA Mini (external).....	79.
2266	PM9600 Internal Modem.....	275.
7934	PM9600SA Modem.....	289.
2264	PM2400FX96 (internal modem/fax).....	95.
1344	PM2400FX96SA (external modem/fax).....	99.
9051	PM14400FX with WinFax Pro Bundle ..	379.
3803	PM14400FX96 (internal modem/fax) ...	359.
2425	PM14400FXSA (external modem/fax).....	399.

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4804	Pocket Fax Windows.....	189.
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1305	Universal Notebook (computer case).....	69.
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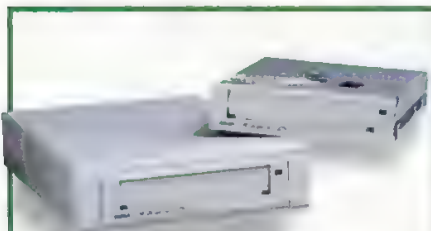
6315	Fax Line Manager 203.....	125.
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TheComplete PC ... 2 years

6069	TheComplete Modem Plus.....	95.
8599	TheComplete Turbo Modem Plus (Ext.) ..	289.
8593	TheComplete Communicator Gold.....	479.

Tripp Lite ... 2 years

6199	Isobar 4-6 (4 outlets, Gold Seal Warranty) ..	49.
6200	Isobar 6-6 (6 outlets, Gold Seal Warranty) ..	59.
6782	Isotel Ultra 8 Surge Suppressor w/tel.....	69.



IOMEGA ... 1 year

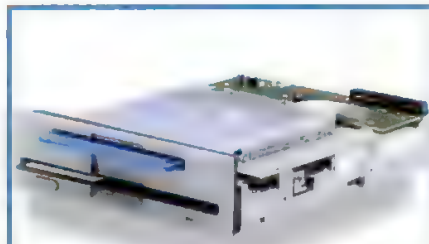
Tape250—QIC & Irwin compatibility in one affordable tape drive! Stores 250M & includes data compression & Central Point Backup.
8480 Tape250 Insider Tape Backup..... \$239.
8481 Insider HH 259. 8482 PC Powered 359.

6807	OMNI 450 LAN Power Backup.....	\$279.
6797	OMNI 600 LAN Power Backup.....	369.
9312	BC500 Power Backup.....	219.
Video Seven ... 7 years		
7362	WIN.VGA 1 MB (1024 x 768,256 color) ..	129.
Zoom Telephonics ... 7 years		
1307	Int. 2400 Baud w/9600 Baud Fax Modem ..	79.
1178	Ext. 2400 Baud w/9600 Baud Fax Modem ..	92.
1494	Ext. 9600V.32bis... 195. 3075 Int. ...	195.
3574	Ext. 2400 Baud V.42/9600 Baud Fax... ..	115.
3386	FaxModem AFC (2400 baud 96S/48R) ..	59.
4430	FaxModem AFX (2400 baud 96S/48R) ..	79.
4429	FaxModem V.32bis 14,400 baud (int.) ..	219.
4428	FaxModem V.32bis 14,400 baud (ext.) ..	259.
7921	Pocket FaxModem.....	87.

DRIVES

Colorado Memory Systems ... 1 year

4194	Jumbo 120 Tape Backup.....	199.
4354	Jumbo 250 Tape Backup.....	269.
1073	Trakker 250 Tape Backup (parallel).....	429.
Conner Peripherals ... 1 year		
2339	CP30104H 120 MB IDE HD (19 ms).....	319.
1337	CP3204 200 MB IDE HD (16 ms).....	539.
3511	CP3544 500 MB IDE HD (12 ms).....	979.



TEAC ... 1 year

4414 3 1/2" 5 1/4" Dual Floppy Drive—Get two drives in one. TEAC's new Dual Floppy Disk Drive gives you both 3 1/2" and 5 1/4" in one, saving you space and money ... \$145.

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6499	Transportable 90 PRO.....	679.
6502	Insider 90 PRO 579. 6501 Dual 90 PRO 1479.	
6343	PC Powered 90 (incl. PC2B & cart.).....	499.
6344	PC Powered 90 PRO (incl. PC2B, cartridge & Central Point Software).....	599.
2500	PC2B-2 Controller.....	149.
2530	90 MB Cartridge.. 149. 2467 Tripak ..	439.
8480	Tape250 Insider Tape Backup.....	239.
8481	Tape250 Inside Half-Height Tape Bckp ..	259.
8482	Tape250 PC Powered Tape Backup....	359.

NEC ... 2 years

6577	CDR37 Portable CD-ROM Drive.....	399.
6582	CDR74 Portable CD-ROM Drive.....	589.
6581	CDR84 for PC/XT/AT.....	599.
7023	MPC Upgrade Kit (with CDR37).....	949.
7021	MPC Upgrade Kit (with CDR84).....	1079.

Pacific Rlm ... 1 year

1304	1.2 MB External (for any parallel port) ..	239.
2761	1.44EX MB Ext. (for any parallel port) ..	239.

Peripheral Land, Inc. ... 1 year

8736	Infinity Floptical Drive.....	399.
8735	Infinity 88 MB Removable (Syquest)....	699.

Quantum ... 2 years

8304	Plus Hardcard II XL 50 MB (9 ms).....	225.
8287	Plus Hardcard II XL 105 MB (9 ms).....	325.
4735	Hardcard E2 127 MB IDE (17 ms).....	349.
4714	Hardcard E2 240 MB IDE (16 ms).....	569.

Summit Memory Systems ... 2 years

6436	SE120 Tape Backup.....	\$215.
TEAC ... 1 year		
6951	1.2 MB Drive for AT.....	65.
4670	1.44 MB Drive for PC/XT (3 1/2").....	59.
4326	1.44 MB Drive for AT (3 1/2", w/Bastech) ..	75.
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6556	256k DRAMs (100 ns, set of 9).....	call
5510	1 MB x 9 SIMMs (80 nanosecond).....	call
2497	4 MB x 9 SIMMs (80 nanosecond).....	call
5746	1 MB Chips (80 ns, set of 9).....	call

DISKS/MEDIA

Fuji ... lifetime

2214	3 1/2" DS Disks (10)..... 9. 2242 (50).....	32.
7379	3 1/2" HD Disks (11)..... 16. 2241 (50).....	59.
7378	3 1/2" HD 11-Pack Preformatted Disks	16.
4863	3 1/2" HD Disks (20) w/storage case.....	26.

Sony ... lifetime

3292	5 1/4" HD Disks (Qty. 10).....	11.
3297	3 1/2" DS Disks (10)..... 9. 6148 (30) ..	25.
3298	3 1/2" HD Disks (10)..... 15. 6375 (30) ..	42.
8185	QD2040..... 14. 1895 QD2120.....	21.

3M ... lifetime

3943	DC2000..... 17. 1581 DC2120.....	23.
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Toshiba ... 2 years

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9755	3 1/2" 2.88 MB ED Disks (Qty. 10).....	53.

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Personal Finance Managers

lists of categories that you can modify).

Once we had entered several months' worth of payments and deposits, we tested the programs' reporting ability to determine what sort of insight we could reap from the data entered.

From basic checkbook and budgeting, we went on to more advanced features: We looked for financial calculators and tax planning tools that would help users actively manage their money rather than merely spending it. We also tested each program's ability to record and monitor personal investments.

Finally, recognizing that banking today is, after all, an electronic business, we looked for connections that would link the finance manager to outside services and information sources. For example, several programs provide links to the electronic bill-paying service CheckFree (see the review), and a few packages can access electronic stock quotes.

Keep in mind that these outside links can carry added costs. You'll need a CompuServe or Dow Jones News/Retrieval account and will have to pay connect-time charges to access stock quotes with Managing Your Money, for example. Checkfree Corp.'s bill-paying service costs \$9.95 per month for the first 20 transactions and \$3.50 for each block of 10 transactions thereafter. (If you figure in the price of postage and checks and the value of your time, though, Check-Free is a fairly modest investment.)

HOW MUCH IS ENOUGH?

The personal finance software packages we evaluate here come in several "strengths." The key to picking the right one is gauging your record-keeping needs. (Price is *not* much of an issue here, since there is no more than a \$30 difference between the least expensive package and the most expensive one. The choice between DOS and Windows isn't much of a factor either, since packages that come in both flavors offer virtually identical functionality in each.)

If you simply want to manage a couple of checking and savings accounts, you'll want a program you can learn easily and work with quickly. Microsoft Money 2.0 is a plain-and-simple checkbook manager that handles most ordinary banking tasks well. If you own a mutual fund or some stocks, you'll want a program that has

some portfolio-tracking capabilities. Intuit's Quicken—either version—does a great job of tracking investments, including keeping historical price information. Serious investors, those who keep a portfolio full of stocks and funds and actively trade investments, will need the power of MECA Software's Managing Your Money 9.0, with its top-of-the-line portfolio manager. Read on for details.

Moon Valley Software Inc.

Balance Point

ALL REVIEWS
BY CHRIS SHIPLEY

Balance Point (\$59.95), from Moon Valley Software, has all the features you would expect to find in a good personal finance manager. This Microsoft Windows-based program has an easy-to-understand checkbook interface, handles most banking chores, and offers budgeting capabilities, preformatted reports, and a simple portfolio tracker. Unfortunately, the program is riddled with design flaws that turn what should be a simple task—managing a checkbook—into a major annoyance.

Balance Point's problems range from minor hurdles to outright financial errors. For example, the program insists that dates be entered with two-digit months and four-digit years (01/15/1993 rather than 1/15/93). Also, memorized transactions are alphabetized in one data-entry window, but they are listed in the order they were entered in another window.

The program lets you create a liability account, such as a credit card account, but the opening balance must be a positive number (even though liabilities are negative numbers by their na-

ture). You have to open the account with a \$0 balance, then enter the outstanding loan amount as your first transaction. Also, many of Balance Point's existing budget categories aren't appropriately linked with relevant tax information.

OFF BALANCE

Balance Point offers little help in getting new users up and running. Launch the program and you're greeted by a log-on

FACT FILE

Balance Point, Version 1.1a

Moon Valley Software Inc., 706 E. Bell Rd.,
#112, Phoenix, AZ 85022; 800-473-5509,
602-375-9502; fax, 602-993-4950

List price: \$59.95.

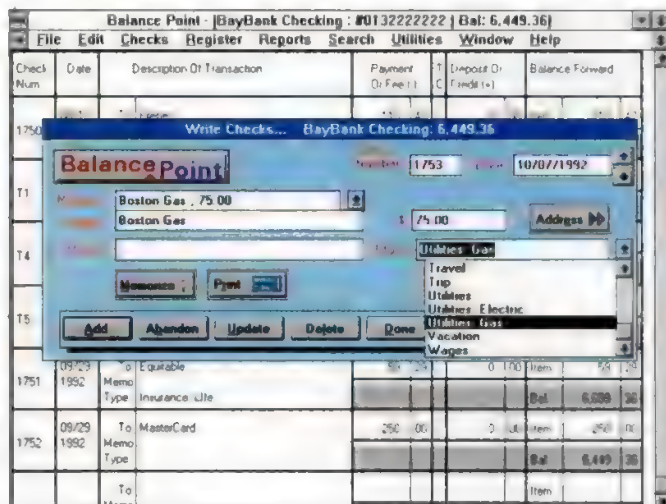
Requires: 2MB RAM, 1.5MB hard disk space, DOS 3.0 or later, Microsoft Windows 3.0 or later.

In short: Moon Valley Software's Balance Point, Version 1.1a, is a no-frills checkbook manager with simple portfolio-management capabilities and an easy Microsoft Windows interface. It offers many of the features found in other finance managers, but it is simply not as well-designed as other products. Despite the package's low price, there are better deals to be had elsewhere.



ON READER SERVICE CARD

screen. Hit Enter and you're presented with an empty screen with only the title and menu bars across the top. You'll need to hunt under the menus to find the choice for creating a new file. The program handles each bank account as a separate file, and when you want to work



Balance Point's check-writing interface lets you choose memorized transactions and budget categories from pull-down lists.



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DISPLAYS NINE
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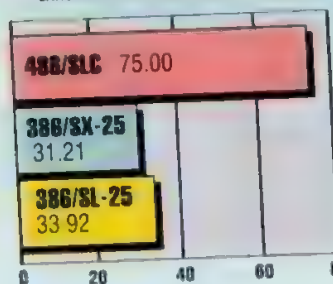
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486/DX-33 **\$1795**

■ 486DX/33 processor ■ 64K cache ■ 4MB RAM ■ 105MB drive ■ 1.2MB & 1.44 MB drives ■ 16-bit SVGA with 1MB ■ Color SVGA monitor(1024 x 768, .28) ■ 1 parallel/2 serial ports ■ Upgradable processor ■ 200W power supply ■ 101-key keyboard ■ MS DOS ■ Windows and mouse

486/DX2-50 **\$1995**

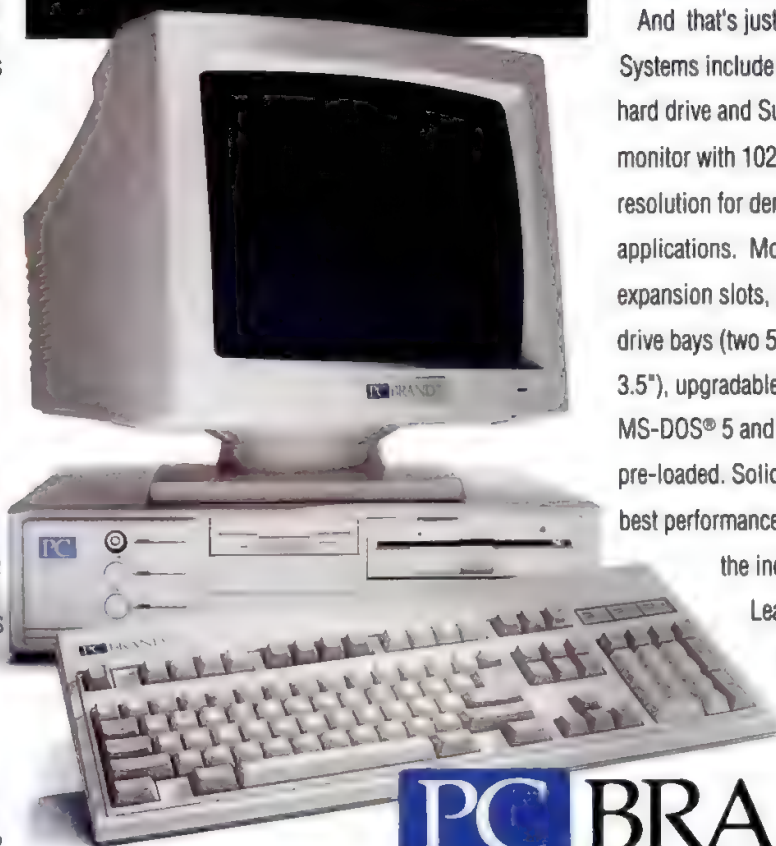
■ 486DX2-50 processor ■ 64K cache ■ 4MB RAM ■ 105MB drive ■ 1.2MB & 1.44 MB drives ■ 16-bit SVGA with 1MB ■ Color SVGA monitor(1024 x 768, .28) ■ 1 parallel/2 serial ports ■ Upgradable processor ■ 200W power supply ■ 101-key keyboard ■ MS DOS ■ Windows and mouse

BEST BUY **\$2195**

■ 486DX2-66 processor ■ 64K cache ■ 4MB RAM ■ 105MB drive ■ 1.2MB & 1.44 MB drives ■ 16-bit SVGA with 1MB ■ Color SVGA monitor(1024 x 768, .28) ■ 1 parallel/2 serial ports ■ Upgradable processor ■ 200W power supply ■ 101-key keyboard ■ MS DOS ■ Windows and mouse

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Personal Finance Managers

SUITABILITY TO TASK				
Balance Point				
	POOR	FAIR	GOOD	EXCELLENT
Checkbook management	●	●	○	○
Budgeting	●	●	○	○
Tax and financial planning	●	○	○	○
Portfolio management	●	●	○	○
Electronic connections	N/A			

with multiple accounts simultaneously, you must open each file. There's no real data sharing between these files, so memorized transactions in one account aren't available in another.

While Balance Point does allow for liability accounts, it doesn't link these accounts to a checking account. That is, when you make a credit card payment from the checking account, the program does not record the payment as a credit in the liability account.

SMALL POINTS

Balance Point does make check printing very easy. Choose Print Checks from the Checks menu, and Balance Point presents you with a list of options for check styles.

Balance Point also provides a wide range of financial reports suitable for both personal and business use; you can either view them on-screen or print them out. It will even graph some reports, such as budget versus actual spending and cash flow.

But aside from a tax summary report, Balance Point does little to help users with financial or tax planning. It doesn't even include simple financial calculators that are typically found in other programs.

Balance Point also has a portfolio tracker. But in this feature, too, is evidence of poor design. You can only enter investments in full shares, and if you have multiple lots of the same stock or fund, you must update the price of each individually.

As it stands, Balance Point, Version 1.1a, represents little more than the framework of a personal finance manager. It would be difficult to recommend such a finance package when there are far more adroit choices available on the market today.

Checkfree Corp.

CheckFree

On the one hand, PC-based checkbook management doesn't get much simpler than CheckFree 3.0 (\$29.95), from Checkfree Corp. On the other hand, CheckFree has done more to propel personal banking into the electronic age than any other personal finance manager.

More than a finance manager, CheckFree is the front end to Checkfree Corp.'s electronic bill-paying service of the same name. The service receives your payment request, then transfers the funds from your account to that of the merchant you are paying. In this way, you can pay all of your bills without ever writing a paper check or worrying about the check being lost in the mail.

Aside from this feature, CheckFree offers few other bells or whistles. The on-screen checklike interface is simple and effective, but the program is still decidedly character-based. It does not include financial calculators, a tax planner, or a portfolio manager. Still, the program does handle most of your basic banking functions reasonably well.

FREE AND EASY

CheckFree tracks two types of accounts:

a CheckFree account, which is associated with the electronic bill-paying service, and non-CheckFree accounts, which are not linked to the service. In the CheckFree account, you establish merchants you want to pay electronically. (You can pay virtually anyone using this service, including individuals.) If CheckFree can't transfer funds di-

rectly to a payee's account, the service simply issues and mails a laser-printed paper check on your account. The program does help by preentering major national companies, such as American Express.

FACT FILE

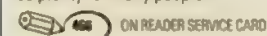
CheckFree, Version 3.0

Checkfree Corp., 720 Greencrest Dr.,
Westerville, OH 43081; 800-882-5280,
614-898-6000

List price: \$29.95. CheckFree bill-paying service: first 20 payments, \$9.95 per month; additional blocks of 10 payments, \$3.50 each.

Requires: 512K RAM, 600K hard or floppy disk space, DOS 2.1 or later, Hayes-compatible modem

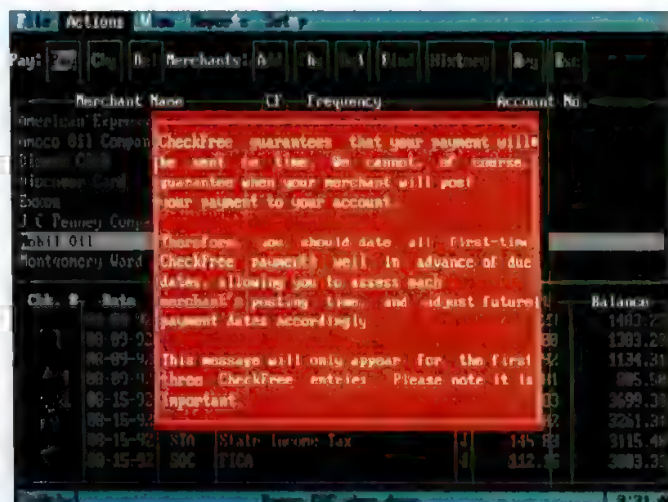
In short: CheckFree offers quick-and-dirty checkbook management with a twist. The program links to Checkfree Corp.'s electronic bill-paying service—a fast, easy, reliable way to pay bills without even printing a check. While it doesn't offer a lot of fancy features, it will be plenty for many people



Once you set up merchants, you're ready to pay bills by picking the merchant from the list, filling in the payment amount, and scheduling the date you want the payment to be made. After you've done this for all the bills you want to pay, you send the payment requests to CheckFree via modem.

A WATCHFUL EYE

If you have scheduled electronic payments but haven't sent them off to the



Before you make a payment to a new creditor, CheckFree reminds you to schedule the payment in advance of the due date.

Personal Finance Managers

SUITABILITY TO TASK				
CheckFree				
	POOR	FAIR	GOOD	EXCELLENT
Checkbook management	●	●	●	○
Budgeting	●	●	●	○
Tax and financial planning	●	●	○	○
Portfolio management	N/A			
Electronic connections	●	●	●	●

service, CheckFree's reminder feature jogs your memory when you enter or exit the program.

One big shortcoming of CheckFree, however, is that it won't print checks. (The company deliberately omits check printing "for obvious reasons," a Check-

free spokesperson says.) You can enter non-CheckFree payments into the check register, but you'll have to do the actual check writing by hand.

CheckFree's Reconcile module is pretty basic, and it is a bit cumbersome to use in some situations. For example, after clicking off cleared transactions, you must manually choose Calculate to see if you're in balance. There's no place to enter bank fees or interest earned, so you'll have to remember to do that before you go into the Reconcile module. If you find a mistake or a missing check, you must exit Reconcile and edit or add the transaction in the check register, then go back into the Reconcile module and start the process over again.

CheckFree, like other programs, has

preset budget categories that you can edit or delete, and you can add new categories to track other expenses. It also offers a view into your spending that no other package does. The budget report shows spending for a particular month and compares it with your average spending in the category along with the variance of the month's total from the average.

While you won't find any other "advanced" finance-management features in CheckFree, you will find enough to make its low price well worth the investment. If you're looking for more financial-management features, however, spend the extra money for Managing Your Money or Quicken, both of which incorporate the CheckFree bill-paying service and offer a greater breadth of capabilities.

■ Investment Software

by Chris Shipley

While checkbook and portfolio software help you manage the money you have, investment software helps you make more money to manage.

You can use these programs to determine what types of investments are best for you, to research companies and mutual funds, and, in some cases, even to buy and sell securities.

Reality Technologies has been at this game as long as anyone in the business. Their product, WealthBuilder 3.0 (\$79.99), is a tool for people who want to work out an investment plan that will help them achieve specific, tangible objectives, such as sending kids through college. WealthBuilder starts by creating your financial-risk profile, then helps you define your goals and structure a plan to meet them. Unlike the financial calculators in most checkbook managers that simply suggest how much you need to sock away for the next 18 years, the one in WealthBuilder writes out a complete prescription for meeting the goals you set. The program suggests how much you should invest and in what types of securities, and it even gives you the background on those securities so you can invest with confidence.

WealthBuilder incorporates a second hallmark investment program,

Smart Investor. Smart Investor recommends specific mutual and money market funds that match your investment objectives. Then it lets you buy those funds through its on-line trading facility. You can use Smart Investor to track fund performance and to get the latest business headlines through Smart Investor's link with Prodigy Interactive Service. Smart Investor sells for \$59.99 plus a \$9.95 monthly service fee (their Gold plan) that provides access to trading capabilities; stock quotes; and mutual fund, money market, and CD information databases. For an additional fee of \$8 per month (their Platinum plan), you receive updates of stock and bond databases. (Reality Technologies Ltd., 3624 Market St., Philadelphia, PA 19104; 215-387-6055.)

SEMPER FIDELITY

Fidelity On-line Xpress (FOX) is an on-line trading and investment tracking program developed jointly by Fidelity Investments and MECA Software and available to customers of the Fidelity discount brokerage firm. Although FOX doesn't give investment advice and recommendations as Smart Investor does, it is a well-designed investment research and trading tool that lets you access real-time stock quotes

and place buy and sell orders directly through the Fidelity trading system. FOX costs \$119.95, with no monthly on-line fees. Dow Jones News/Retrieval, Standard & Poor's, and TeleScan charge additional fees for information accessed via FOX. (Fidelity Investments, 82 Devonshire St., Boston, MA 02109; 800-544-0246.)

PRODIGAL CHOICE

A third service that combines on-line information gathering and trading is Prodigy Services Co.'s Strategic Investor Custom Choice. Strategic Investor includes a database of stocks and mutual funds information, plus a variety of analysis and chart information. Prodigy also provides stock quotes with a 15-minute delay and trading access through PCFN, an on-line discount broker. Strategic Investor provides a wealth of information, but unlike Smart Investor, it doesn't give much support in analyzing or acting on that information, making Strategic Investor more suitable for experienced than for inexperienced investors. The basic Prodigy membership fee is \$14.95 per month; Strategic Investor costs an additional \$14.95 per month. (Prodigy Services Co., 445 Hamilton Ave., White Plains, NY 10601; 800-776-3449.) □

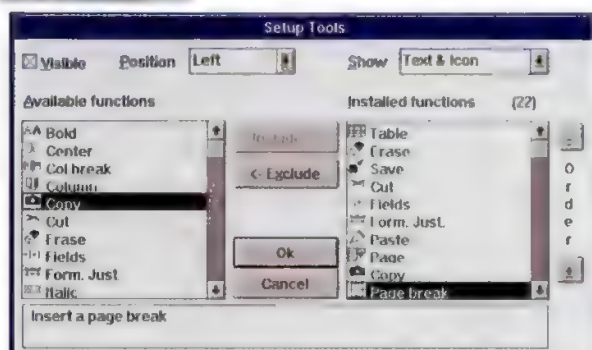
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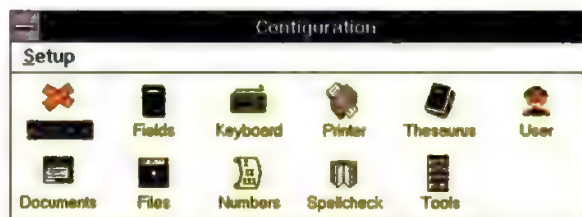
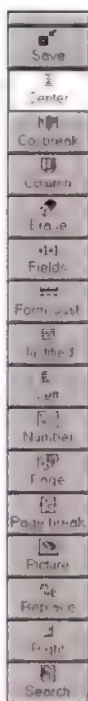
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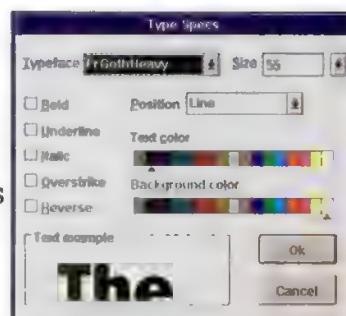
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CIRCLE 348 ON READER SERVICE CARD

Personal Finance Managers

Hooper International Inc.

"Cheque-It-Out"

For a program that claims it will help you "manage your money like a financial whiz," Hooper International's "Cheque-It-Out" (\$69.95) requires too much whiz up front for any user not familiar with basic bookkeeping. "Cheque-It-Out" is



true double-entry accounting, and the program makes no effort to hide this—except maybe in its packaging.

You start by creating a chart of accounts (actually, the best place to start is by modifying the sample chart that comes with the program). A chart of accounts isn't, as you might think, a list of your checking, savings, and money market accounts. A chart of accounts includes these bank accounts, but it also includes what other packages call *budget categories*; things such as a car loan and clothing and medical expenses. Each item in a chart of accounts is an asset, a liability, income, or an expense. In double-entry accounting, you *debit* (write a check) from one account and *credit* (allocate the amount) to another category. "Cheque-It-Out" facilitates this process, but you still need to enter the expense code for every check in order to complete the check input.

These concepts aren't too difficult to

grasp if you have the time to spare, but "Cheque-It-Out" doesn't help users enough. The manual suggests that those unfamiliar with accounting read the manual from cover to cover before launching into the program, and it refers accounting neophytes to a five-page tutorial that briefly explains the elements of accounting.

If you have the patience and the time, you'll find "Cheque-It-Out" to be a fairly powerful accounting program. It will handle all your banking chores, and it will track and report on spending in a virtu-

FACT FILE**"Cheque-It-Out," Version 2.0**

Hooper International Inc., P.O. Box 50200,
Colorado Springs, CO 80949; 800-245-7789,
719-528-6500; fax, 719-528-8997

List price: \$69.95.

Requires: 448K RAM, 480K hard or floppy disk space,
DOS 2.0 or later.

In short: Hooper International's "Cheque-It-Out" is double-entry bookkeeping disguised in colorful screens and zippy menus. It has the power to handle most small-business accounting chores, but it does not offer the hand-holding and ease of use we have come to expect in personal finance software. Unless you have a firm grasp of accounting principles, try one of the other packages.



ON READER SERVICE CARD

ally unlimited number of categories. The program uses a helpful on-screen check to record transactions, and it makes account reconciliation easier by spotting checks that haven't yet cleared the bank.

"Cheque-It-Out" provides robust reporting, including a budget-variance report that shows how your spending compares with the target amounts you set for a given budget period. The program also includes a raft of financial planning tools, including loan analysis and amortization sched-

SUITABILITY TO TASK**"Cheque-It-Out"**

	POOR	FAIR	GOOD	EXCELLENT
Checkbook management	●	●	○	○
Budgeting	●	●	○	○
Tax and financial planning	●	●	○	○
Portfolio management	●	○	○	○
Electronic connections	N/A			

ules, and calculators for depreciation, present and future value of annuities, and internal rate of return.

But for most people, using "Cheque-It-Out" to manage a checkbook is like using a sledgehammer to drive a nail: too much tool for the task. When you compare this investment in time and learning with that of other personal finance managers, there is simply no way to recommend "Cheque-It-Out," Version 2.0, for anyone but those who have bookkeeping savvy.

MECA Software Inc.

Managing Your Money

Managing Your Money 9.0 (\$79.95), from MECA Software, is a top-notch DOS-based personal finance package. From simple checkbook management to complex portfolio investment decisions, the program has all the tools you need to have to be a smart money manager. Best of all, in this newest version, the package is easier than ever for the average person to learn and grow with.

After you have installed Managing Your Money, the "Hello, New User" feature introduces you to the program. This automated tour guide asks you a handful of questions and then uses your answers to set up your first account. Although "Hello, New User" does not give the thorough coaching found in Quicken's QCards, it covers the program's basic navigation.

**TRANS-ACTS**

Managing Your Money has an on-screen check interface that you can use to enter



Despite the friendly looking interface of "Cheque-It-Out," you can't record a check without choosing an "Expense" number.

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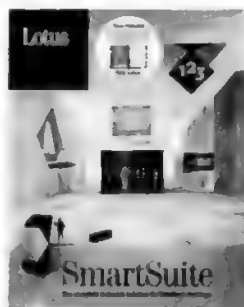
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SOFTWARE SPECTRUM



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Smart Suite	\$795	\$439
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Ami Pro 3.0	\$495	\$239
Freelance Graphics V1.0 for Windows	\$495	\$325
cc:Mail Windows Platform Pack	\$495	\$349

Lotus

SmartSuite for Windows

*Prices subject to change. Offer good until 12/31/92.

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SOFTWARE
Personal Finance Managers

► **S U M M A R Y O F F E A T U R E S**

Personal Finance Managers

Products listed in alphabetical order

■ = YES □ = NO



	Balance Point	CheckFree	"Cheque-It- Out"	Managing Your Money	Microsoft Money	MoneyCounts	
List price	\$59.95	\$29.95	\$69.95	\$79.95	\$69.95	\$49.00	
User interface	Windows	DOS	DOS	DOS	Windows	DOS	
General Features							
Calculator	■	■	■	■	■	■	
Calendar	□	■	□	■	□	■	
Notepad	□	□	□	■	□	■	
Phone list	□	□	□	■	□	□	
To-do list	□	□	□	■	□	□	
Data backup	■	■	■	■	■	■	
Banking Functions							
Maximum number of accounts	128	1	2,000	32,000	63	65,000	
Memorizes recurring transactions	■	■	■	■	■	■	
Schedules future transactions	□	■	■	■	■	■	
Bill payment reminder	□	□	□	■	■	■	
At boot-up	N/A*	N/A*	N/A*	□	□	□	
When launching Windows	N/A*	N/A*	N/A*	N/A**	□	N/A**	
When starting application	N/A*	N/A*	N/A*	■	■	■	
Reconciles account	■	■	■	■	■	■	
User can edit in reconciliation mode	■	□	□	■	■	■	
Bill Payment							
Interface to BillPay USA	□	□	□	■	■	□	
Interface to CheckFree	□	■	□	■	□	■	
Prints laser and dot-matrix checks	■	□	■	■	■	■	
Prints check register	■	■	■	■	■	■	
Budgeting Features							
Includes preset budget categories	■	■	■	■	■	■	
Split transactions among categories	■	■	■	■	■	■	
Automatically sets up budget amount	■	□	■	■	■	■	
Reports							
Predefined reports:							
Budget variance	■	■	■	□	■	■	
Budget versus actual	■	■	■	■	■	■	
Cash flow	■	□	■	■	■	■	
Chart of accounts	■	□	■	□	□	■	
Income and expense	■	■	■	■	■	■	
Net worth	■	□	■	■	■	■	
Profit and loss	■	□	■	■	□	■	
Tax summary	■	□	□	■	■	■	
Custom reports	□	□	■	■	■	■	
User can preview reports on-screen	■	■	■	■	■	■	
Prints reports	■	■	■	■	■	■	

N/A*—Not applicable: The product does not have this feature

N/A**—Not applicable: This is not a Windows-based product

SOFTWARE
Personal Finance Managers

SUITABILITY TO TASK

Managing Your Money

	POOR	FAIR	GOOD	EXCELLENT
Checkbook management	●	●	●	●
Budgeting	●	●	●	●
Tax and financial planning	●	●	●	●
Portfolio management	●	●	●	●
Electronic connections	●	●	●	●

individual checks. In addition, the product offers several ways to enter recurring transactions. First of all, instead of auto-

Alert List each time you launch the program.

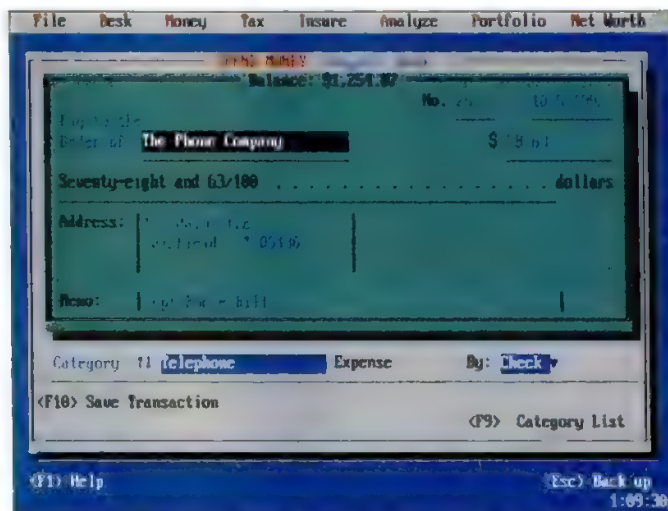
In both the Quick List and the Alert List, Managing Your Money records transactions to a specified account. It's best to use the Alert List for recurring transactions of the same amount, such as a salary deposit, and to use the Quick List for recurring transactions of varying amounts, such as a credit card payment or a telephone bill.

MONEY MANIPULATION

In addition to making transactions simple, Managing Your Money supports easy funds transfers among accounts, loan tracking, budget allocation, and other basic banking functions. But it's what Managing Your Money offers beyond basic banking that truly sets it apart from the rest.

The package provides the most comprehensive tax and financial planning and portfolio management of any product reviewed here. Managing Your Money has

the standard retirement and college planning tools found in most packages. Then



With Managing Your Money, you can cursor up and down to see all your categories, or you can hit F8 to see a complete list.

matically memorizing transactions, Managing Your Money gives you the option of memorizing by selecting a function key.

You can also enter transactions into your checkbook using the Quick List. You can add previously entered transactions to the Quick List via a function key selection, or you can manually enter them on the list. Then, when you want to pay bills or register deposits, you go down the Quick List, marking transactions and adjusting dollar amounts as necessary.

The third method of recording recurring transactions is by using Managing Your Money's Alert List. The Alert List acts as a reminder for payments or deposits that occur on a regular schedule. You add transactions to the list in exactly the same way you would for the Quick List. The difference is that you'll be reminded of payments due for items on the

FACT FILE

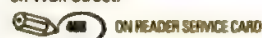
**Managing Your Money,
Version 9.0**

MECA Software Inc., 55 Walls Dr.,
Fairfield, CT 06430-0912; 800-288-6322,
203-256-5000; fax, 203-256-5159

List price: \$79.95.

Requires: 512K RAM, 4MB hard disk space, DOS 3.0 or later.

In short: MECA Software's Managing Your Money, Version 9.0, offers full-strength personal finance management while remaining reasonably easy to use. With its links to on-line stock quotes and its ability to notify you of market changes, this program is the only real choice for serious investors who need to keep an eye on Wall Street.



Quicken for DOS	Quicken for Windows	WinCheck
\$69.95	\$69.95	\$69.99
DOS	Windows	Windows

■	■	□
■	□	□
□	□	□
□	□	□
□	□	□
■	■	■

255	255	Unlimited
■	■	■
■	■	■
■	■	■
■	■	□
N/A**	■	□
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CONTINUES

SOFTWARE
Personal Finance Managers

► **S U M M A R Y O F F E A T U R E S**

Products listed in alphabetical order							
☒ = YES ☐ = NO	Balance Point	CheckFree	"Cheque-It- Out"	Managing Your Money	Microsoft Money	MoneyCounts	
Charts and Graphs							
Predefined charts	☒	☐	☒	☒	☒	☒	
Budget versus actual	☒	N/A*	☒	☒	☒	☒	
Cash flow	☒	N/A*	☒	☒	☒	☒	
Income and expense	☒	N/A*	☒	☒	☒	☒	
Spending by category	☒	N/A*	☒	☒	☒	☒	
Custom charts	☐	☐	☒	☒	☒	☒	
Portfolio Management							
Supports multiple portfolios	☒	☐	☐	☒	☐	☒	
Keeps historical price information	☒	☐	☐	☒	☐	☒	
Contains asset-allocation analyzer	☐	☐	☐	☒	☐	☐	
Links to on-line quote service	☐	☐	☐	☒	☐	☐	
Financial Planning and Calculators							
Insurance planner	☐	☐	☐	☒	☐	☐	
Retirement planner	☐	☐	☐	☒	☐	☐	
Savings goal planner	☐	☐	☐	☒	☐	☒	
Tuition planner	☐	☐	☐	☒	☐	☐	
Loan calculator	☐	☐	☒	☒	☒	☒	
Mortgage calculator	☐	☐	☒	☒	☒	☒	
Buy-versus-lease analysis	☐	☐	☐	☒	☐	☐	
Calculates amortization tables	☐	☐	☒	☒	☒	☒	
Loan Tracking							
User can link loan account to checking account	☐	☐	☒	☒	☒	☐	
Credits loan account when payment is made from checking	☐	☐	☒	☒	☒	☒	
Automatically splits payment between principal and interest	☐	☐	☒	☒	☒	☒	
Data Import Formats							
ASCII	☐	☐	☒	☒	☒	☒	
.DBF	☐	☐	☐	☐	☐	☐	
.QIF	☒	☐	☐	☒	☒	☐	
.TXF	☐	☐	☐	☐	☒	☐	
.WK1	☐	☐	☐	☒	☐	☒	
.XLS	☐	☐	☐	☒	☐	☐	
Supports Dynamic Data Exchange	☐	☐	☐	☐	☒	☐	
Help							
On-line content-sensitive help	☒	☒	☒	☒	☒	☒	
On-line "coach"	☐	☐	☐	☒	☒	☒	
Sample data	☒	☐	☒	☒	☐	☐	
Help with accounting principles	☐	☐	☒	☒	☒	☒	
Technical Support							
Unlimited free support	☒	☐	☐	☒	☒	☒	
Toll-free support	☐	☐	☐	☐	☐	☐	

N/A*—Not applicable: The product does not have this feature

Personal Finance Managers

it packs a load of calculators to help you set a savings goal, decide between lease or purchase packages, refinance a mortgage or some other loan, do cash flow forecasting, or even determine the proper withholding for your W-2 form.

This package is also the only real choice for active investors. Managing Your Money has a full portfolio manager that even helps you determine what investments are good targets to unload before the end of a tax year. You can also have the program monitor your investments by automatically dialing Dow Jones News/Retrieval to collect stock quotes and update the prices in your portfolio. If prices hit a threshold you set, Managing Your Money will alert you via an on-screen or printed message, or via a SkyTel pager.

In addition to the connection to Dow Jones, the package offers integrated links to the electronic bill-payment service CheckFree, and it offers data import from BillPay USA on Prodigy.

These features combine to make Managing Your Money the most complete finance manager among those we review in this feature. While not everyone will have use for all these functions, few will outgrow them.

Microsoft Corp.

Microsoft Money

Open the box for Microsoft Corp.'s Microsoft Money 2.0, grab the disks, and toss the manual; you'll probably never need it.

Money (\$69.95) employs an on-screen transaction "coach" that talks you through the process of setting up accounts and entering your first few transactions. The coach appears at the bottom of the screen, telling you what to do and what kind of information is appropriate for each data field. When you no longer need this as-

SUITABILITY TO TASK

Microsoft Money

	POOR	FAIR	GOOD	EXCELLENT
Checkbook management	●	●	●	●
Budgeting	●	●	●	●
Tax and financial planning	●	○	○	○
Portfolio management	●	●	○	○
Electronic connections	●	●	○	○

sistance, you can turn the coach off.

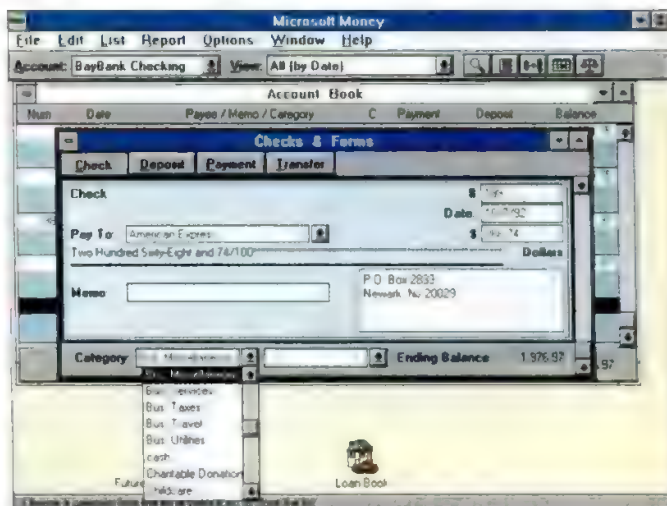
Tips throughout the program give you suggestions on how to use it more effectively. They pop up with a basic message and the option to ask for more detail.



When you create an account, Money gives you a list of account types and explains what each is used for. Make your selection and the program prompts you for the appropriate information to establish that type of account.

As part of account setup, the program asks you to choose budget categories for business, home, or both. You can modify, add, or delete categories on the fly as you find necessary.

Checkbook management with the package is a breeze. As you write checks or make deposits, Microsoft Money memorizes them so that you never have to completely fill out an electronic check or deposit slip more than once. As you type the name of a payee or payor, Micro-



Microsoft Money lets you quickly switch among checks, deposits, withdrawals, and transfers for fast transaction entry.

ENDS

Personal Finance Managers

FACT FILE

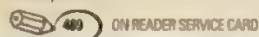
Microsoft Money, Version 2.0

Microsoft Corp., One Microsoft Way,
Redmond, WA 98052-6399; 800-426-9400,
206-882-8080; fax, 206-883-8101

List price: \$69.95.

Requires: 1MB RAM, 1.5MB hard disk space, DOS 3.0 or later, Microsoft Windows 3.0 or later

In short: Microsoft Corp.'s Microsoft Money, Version 2.0, is a simple but elegant personal finance manager. Its on-line coach gets you up and running quickly. The program handles most banking functions with aplomb, but it falls short when you push it to more advanced tasks, including portfolio management and financial planning. Microsoft Money supports data feeds from BillPay USA.



ON READER SERVICE CARD

soft Money completes the name as it recognizes matches with the memorized transactions. This type-ahead feature works when filling in budget categories, too.

Money handles loan payments particularly well. When you write a check for a MasterCard payment, for example, you choose *transfer* as the category and *MasterCard* as the subcategory. Money records the payment in your checkbook,

lets you print a paper check, and notes the credit in the loan account.

BUDGET WISE

Budgeting, too, is a simple task in this program. After entering a month or so of transactions, you're ready to take advantage of AutoBudget, which sets up spending and income targets in each category based on past transactions. AutoBudget is a great starting point from which you can add or alter numbers.

One part of the manual you may actually need is its detailed instructions on how to use Money's accounts structure to handle investment portfolios. Money supports asset accounts but doesn't offer an explicit portfolio manager.

As terrific as Money is at handling basic banking functions, it'll leave you short when the time comes to set out financial plans or evaluate your tax situation. Aside from preformatted reports on tax categories, Money's tax-planning features are limited. Simple loan and mortgage calculators figure payments and print amortization schedules—the extent of Money's finance-planning support.

The program does provide a link to BillPay USA, the electronic bill-payment service that is offered exclusively through Prodigy Interactive Service. Money can

import transactions made on-line into your check register.

Money is a good place for many people to start with PC-based checkbook management. It's simple to use and will handle the bulk of your banking chores. Unless your accounts include stocks and mutual funds that you want to track, Microsoft Money is a safe (though limited) bet for Windows users.

Parsons Technology Inc.

MoneyCounts

The personal edition of Parsons Technology's MoneyCounts 7.0 (\$49) traces its heritage to double-entry bookkeeping, but its new and improved check interface goes a ways toward hiding this family secret. Not that double-entry accounting is bad. Indeed, it's at the heart of good financial record keeping. But PC users don't have to know that. Instead, the best personal finance packages hide their accounting and show something more familiar—usually a checkbook. That's all most people re-



■ Shareware: *Budgeting on a Budget*

by Chris Shipley

You don't need to make a big cash investment to start managing your finances on your PC. Dozens of good finance programs—from checkbook managers to small-business accounting packages—are available as shareware. These programs are a great place to begin if you're not convinced that you really need a personal finance manager. At one time, you can try both the package and the category.

Express Check from Expressware Corp. is an inexpensive (\$35) DOS-based checkbook manager that offers check-printing and budgeting capabilities. A bill-payment reminder alerts you when your previously scheduled payments become due. The program has a simple, character-based interface, and while it offers many features found

in commercial packages, it's a bit rough-hewn. The price is right, but you may be able to find a version of Quicken for DOS or Windows at a street price that's comparable.

The Public Brands Software (PBS) library on ZiffNet gives its *best* rating to Custom Technologies' **CheckMate Plus**, a checkbook-based general ledger package that includes budgeting capabilities and a built-in calculator. The DOS-based program carries a \$60 registration fee. It surpasses commercial products such as "Cheque-It-Out" in ease of use and matches the functionality of others. CheckMate Plus even includes an accounting primer that teaches novice users the basics of accounting.

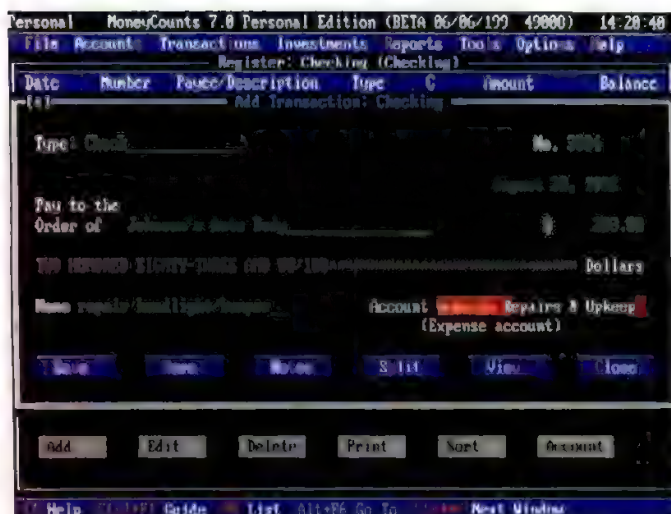
Money Smith, written by Bradley Smith, is a Windows-based double-en-

try bookkeeping program that tracks investments, prints checks, and manages your budget. You can use Money Smith to generate net worth statements, cash flow reports, and tax summaries. While its capabilities are many, its interface is confusing. Still, the low \$30 registration fee makes Money Smith a standout.

If your money manager is lacking financial planning capabilities, you might want to try **Hi, Finance!** from Brighthouse Solutions. Available in both DOS and Windows versions, Hi, Finance! provides a handful of financial calculators to figure loan rates and amortization schedules, calculate taxes, and set savings-plan goals. Registration is \$39.

These programs are available in the PBS library on ZiffNet and ZiffNet for Prodigy. See the PC MagNet section on page 12 for details on connecting to ZiffNet. □

SOFTWARE Personal Finance Managers



In its newest version, MoneyCounts uses a checkbooklike interface for faster, easier data entry.

ally need to know about accounting.

The check interface moves MoneyCounts in the right direction, although it only partially hides the program's accounting concepts and jargon. Those unfamiliar with charts of accounts will spend an hour or so feeling their way around the program before they're comfortable with the setup.

Fortunately, there's an accounting guide in the help menu that clearly explains account setup. When you're ready to create your own chart of accounts, MoneyCounts prompts you for information, explains your options, and provides accounts for home, business, church, farm, and rental properties.

FACT FILE

MoneyCounts, Version 7.0

Parsons Technology Inc., One Parsons Dr.,
P.O. Box 100, Hiawatha, IA 52233-0100;
800-223-6925, 319-395-9626;
fax, 319-393-1002

List price: \$49.

Requires: 512K RAM (640K RAM recommended), 2MB hard disk space, DOS 2.11 or later

In short: Parsons Technology's MoneyCounts, Version 7.0, is a complete personal finance manager that hides, if not completely, its double-entry bookkeeping origins. This package's learning curve is a bit steeper than those of other financial managers reviewed here, but if the user is up to speed, it provides the money-management capabilities to support most needs.

478 ON READER SERVICE CARD

IT GETS EASIER

Once you have gotten this far, you will find that the rest of the program is rather easy to use. You write checks (or, in a nod to MoneyCounts' heritage, "post" them), assign income and expenses to budget categories, and then split a transaction among several categories. The program lets you set up "automatic entries" to handle recurring transactions, such

as a mortgage payment. It reminds you as these transactions become due.

While MoneyCounts doesn't inte-

SUITABILITY TO TASK				
MoneyCounts				
	POOR	FAIR	GOOD	EXCELLENT
Checkbook management	●	●	●	●
Budgeting	●	●	●	●
Tax and financial planning	●	●	●	●
Portfolio management	●	●	●	●
Electronic connections	●	●	●	●

grate access to the bill-paying service CheckFree, you can import data from the CheckFree software package.

MoneyCounts lets you choose whether a new account should be reconcilable (such as checking or savings) or not (credit cards, for example), and explains the difference between the two. When it's time to reconcile an account, the program prompts you for the bank statement information, then keeps a running tally of cleared transactions as you mark them off. If you find a mistake, you can edit or add a transaction from within the reconciliation module.

INVESTMENT WATCH

The program also includes a portfolio manager that allows you to track investments. You can track the stocks, bonds, and funds you buy and sell, as well as update their market prices. MoneyCounts keeps a record of these prices and uses

it to provide historical trend reports.

MoneyCounts offers a rich array of reports for both banking and investment activities. You can generate a general ledger, an income and expense statement, a balance sheet, a cash flow statement, and tax summary reports, or you can use one of several report formats to analyze investments. You can generate and print reports on the maturity dates of investments, get an investment earnings report or a valuation of gains and losses, or take a historical view of your investments. Most of these reports can also be viewed and printed as graphs.

MoneyCounts is better at helping you track the money you have than it is at helping you plan how to use your money more wisely. Among its scant financial planning tools, however, is one handy utility, "Personal Income Tax Estimator," that provides a quick estimate of your taxes for the year.

In addition, MoneyCounts includes an address book, a calendar, and a notebook—all extremely useful for keeping other finance-related information in one place.

MoneyCounts 7.0 is a solid finance manager, and its new interface is a big improvement over past versions. Though it can't match Quicken's ease of use, it may still be the right choice for people who prefer a more strict bookkeeping metaphor.

Intuit Inc.

Quicken for DOS

Quicken for Windows

Since its introduction eight years ago, Intuit's Quicken has dominated the personal finance software category. Indeed, Quicken, in both its DOS and Windows



forms, has been the number-one-selling home application for nearly as long as anyone has been keeping track. The recent upgrades on both platforms only shore up the products' already solid position.

When Quicken for Windows, Version 1.0, was introduced last year, it lacked

some of the features in the then-current DOS version (5.0). Now the two versions of this program are distinguishable only by their operating platforms. They offer nearly identical features, from the bone-simple checkbook and budget-tracking capabilities to their innovative links to external banking services.

Both draw you into the process with an automated system of bite-size context-sensitive help advisories (they're called QCards and can be disabled or reenabled at any time) and a tutorial that takes you

on a tour of the program and helps you set up your accounts. This, along with the exceptional on-line help system, makes the Quicken manual unnecessary.

HOW EASY CAN IT GET?

If you can write a check or record a deposit in a checkbook register, you can use Quicken, which will help you do the job with a fraction of the time and effort. The program memorizes your transactions as

you record them. Then, when you begin to enter recurring transactions, the QuickFill feature searches for the match-

ing transaction and completes the entry, including whatever category, and even the amount you last added for that transaction.

You can schedule payments in advance or set up the system to remind you of regularly recurring transactions. The

*Regardless of platform,
Quicken offers
intuitive financial
management without
the hassle of
paperwork.*

SUITABILITY TO TASK				
	POOR	FAIR	GOOD	EXCELLENT
Checkbook management	●	●	●	●
Budgeting	●	●	●	●
Tax and financial planning	●	●	●	○
Portfolio management	●	●	●	●
Electronic connections	●	●	●	●

▪ Eight Tips for Money Management Success

by Chris Shipley

Like so many things in life, moving headlong into a personal finance manager, even the best of them, can lead to frustration and end in abandonment of the program. Here are some tips to help you get the most from your program of choice.

Start slowly. You don't have to load every last morsel of your financial data into the program at one sitting. An easy way to get started is to begin with your last fully reconciled bank statement. Use the *ending balance* amount as the beginning balance when you set up your checking and/or savings account. Then enter only the payments and deposits you've made since that statement. Unless you really need to enter a past activity history for budget-building reasons, this is all the foundation you'll ever need.

Memorize frequent transactions. Use your software's ability to memorize transaction input so that information such as payee, address, category—and, in certain cases, the amount—will be filled out automatically each time you make repetitive payments. On the other hand, be selective when choosing which transactions your software will memorize and save for recurring use. Too many transactions can actually

slow down the check-writing process.

Budget carefully. Most programs come with budget categories already set up. Use these as a basis for building your personalized list, creating new categories as you need them. But don't overdo it. Avoid defining budget categories too narrowly. It will take you longer to find the right category as you allocate expenses, and too many categories can yield reports that are less meaningful than those that contain broader categories.

Track tax categories. The most useful information that you can glean from a checkbook manager may be your deductible expenses. Make sure to establish budget categories for items that are tax deductible, such as medical expenses, mortgage interest, and taxes paid.

Record paycheck deductions. Record paychecks as gross deposits, then make payments for your federal and state withholdings, FICA payments, 401K deduction, and so forth. Use the program's memorization and recurring scheduling features to make this easier. Then, even though your bank statement will only show the net deposit, you'll have a complete, current record of income and withholding for your tax records.

Establish a habit for paying bills. Plan to pay all your bills at one or two quick sittings each month. Save up ATM receipts and check-register notations and enter them during one of these sessions. This is much quicker and more convenient than firing up the program each time you incur an expense or make a deposit.

Use electronic payment services. If the package you choose links to BillPay USA or CheckFree, use the service; they save both time and money. First, you can be sure your payment will arrive at the merchant's *when you want it to*, saving late charges. Second, it's faster than addressing, stamping, and licking envelopes.

Back up your records to disk. Old news, but it's much more crucial when your personal finances are at stake. If your system goes down or the personal finance manager's data is somehow corrupted, you should *not* be caught without a disk that reflects your most recent check register and other financial information. With it, you can rebuild your financial picture with little more than aggravation; without it, you're in trouble. Most programs include a backup feature and will remind you to back up data files when you exit the program. Use it. □

Here's How To

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NEW Version 9.0.
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From Quicken®

Balance. Gives you current balance after every transaction.

Payee. Remembers every check you've ever written. Never enter a payee twice.

Address. Prints it on your check and remembers it.

Category. Assigns your transaction to one or more budget categories.

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Check Number. Remembers last check number and inserts the next one.

Memo. Enter a brief description or a memo of any length.

By. Pay bills by check or electronically via CheckFree®



New Andrew Tobias' **Managing Your Money®** Version 9.0 takes care of everything. With it, you'll pay bills, balance your checkbook, track your investments, keep all your records, phone numbers and calendar, print reports, and more.

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Managing Your Money helps you analyze and plan your finances. You'll feel better knowing you've taken care of your responsibilities and can meet your commitments.

Well Within Your Grasp

Managing Your Money takes minutes to install, learn and use. You'll enjoy almost instant control over your finances. If it has more than you need right away, the tools are there when you're ready.

Here's A Quick Tour

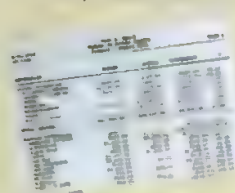
- Organize and track all your expenses by Category and Subcategory. See where your hard-earned money is going.
- Print out your checks automatically. Reminds you of your recurring payments (mortgage, car loan, insurance bills, etc.).
- Import data from Quicken for more complete analysis and download financial data from PRODIGY's® BillPay USA™ and PCFN™ with the separate Import Capability utility disk. Check box on order form to get it free.
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All rights reserved. System Requirements. **DOS** — IBM PC, XT, AT, PS/1, PS/2, or IBM compatible. DOS 3.0 or later. 512K RAM. Hard disk. **Macintosh** — System 6.0.2 or later. System 7 compatible. Mac Plus or later. 2MB of memory recommended. 3 MB of free hard disk space for installation. Macintosh version does not perform all of the functions in DOS version.

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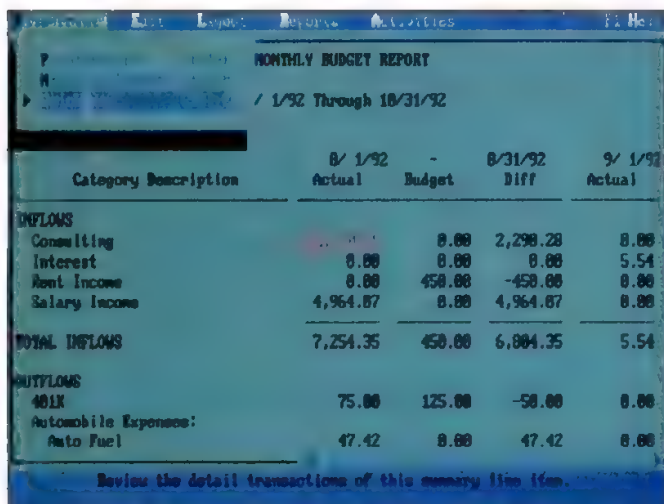
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Personal Finance Managers



MONTHLY BUDGET REPORT
1/92 Through 10/31/92

Category Description	8/ 1/92 Actual	Budget	8/31/92 Diff	9/ 1/92 Actual
INFLOWS				
Consulting		0.00	2,298.28	0.00
Interest	0.00	0.00	0.00	5.54
Rent Income	0.00	450.00	-450.00	0.00
Salary Income	4,964.87	0.00	4,964.87	0.00
TOTAL INFLOWS	7,254.35	450.00	6,804.35	5.54
OUTFLOWS				
401K	75.00	125.00	-50.00	0.00
Automobile Expenses:				
Auto Fuel	47.42	0.00	47.42	0.00

Review the detail transactions of this memory item (f6).

Quicken for DOS's QuickZoom let's you see the transaction-level detail behind your budget numbers.

BillMinder utility installs itself into your AUTOEXEC.BAT or WIN.INI file and pops up to remind you when a scheduled payment is due—even if you're not running Quicken.

Quicken is preloaded with budget categories for home and business. You can modify these categories and add new ones of your own. To make budget tracking precise, Quicken allows you to establish subcategories, so that you can see, for example, your overall travel-budget expenditures and the detail within that category, such as airfare, lodging, and meals. Then, as you enter transactions, you can

include charts, so you can view the data graphically, as well. Obviously, there's a great deal of information behind these charts, and Quicken let's you drill down by double-clicking on the chart, through all the levels, right down to a single transaction on the check register.

QuickZoom—an unusual feature that's great for people who want to see what's really going on in their finances—lets you see the numbers behind the numbers in most Quicken reports. If, for example, you want to see what transactions account for a total within your "charitable contributions" category, choose QuickZoom to get a list of checks you wrote to various organizations.

Quicken offers perhaps the simplest check printing of any personal finance management package. The handy print setup menu lets you choose the check style and individual check numbers for printing. And the program's Check Align feature makes it easy to line up form-fed checks in your dot matrix printers, so that you're not likely to waste checks. Intuit offers laser checks, report forms, and envelopes, too.

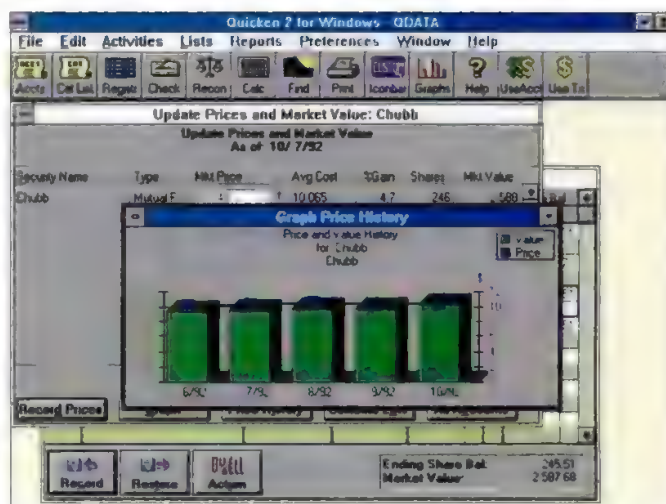
PORTFOLIO TRACKER

Quicken provides a straightforward portfolio manager to meet the needs of most investors. In it, you can enter investment transactions, update prices, and record earnings. Quicken keeps a record of all price changes and can report back a price history of an investment.

Financial and tax planning is not Quicken's strong suit. But the package does provide a variety of calculators that are easy to use. These analyze investment and refinancing opportunities, help plan for college tuition or for retirement, and calculate loans and amortization schedules. You can extract Tax Summary Reports from your budget in order to get a sense of your tax liability, but the program does not offer much advice on tax planning.

Quicken's trump card, however, is its electronic connections to outside banking functions. The first forays into this area were CheckFree, an electronic bill-paying service (see the CheckFree stand-alone product review), and Accuret, a bank statement reconciliation service offered by select banks specifically for Quicken users. The program also provides data links to BillPay USA, which allows you to import financial information into your Quicken check register, and Strategic Investor stock quotes, both available through Prodigy.

But Intuit now goes a giant step further in automating financial record-keeping with its innovative IntelliCharge, a Gold VISA card issued by Primerica Bank. IntelliCharge attaches budget cat-



Quicken for Windows keeps a price history of your investments, enabling you to see portfolio performance.

PC FACT FILE

EDITORS CHOICE

**Quicken for DOS,
Version 6.0**
**Quicken for Windows,
Version 2.0**

Intuit Inc., 155 Linfield Ave., P.O. Box 3014,
Menlo Park, CA 94026-3014; 800-624-8742,
415-322-0573; fax, 415-329-2785

List price: \$69.95 each

Requires: DOS version: 512K RAM (640K RAM for IntelliCharge), 2MB hard disk space, DOS 2.0 or later, graphics card (for graphs). Windows version: 2MB RAM, 3MB hard disk space, DOS 3.0 or later, Windows 3.0 or later

In short: In both the DOS and Windows arenas, Quicken is the perennial leader in personal finance management because it is the easiest to learn and use and has the greatest flexibility and features

ON READER SERVICE CARD

The not-so-hard drive upgrade.

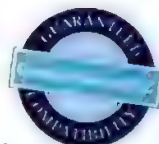


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IDC Weekly Update

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"Digital's system was the overall winner in PC Week Lab's tests. Its video subsystem beat out all the others."
PC Week, Oct. 5, 1992

1-800-PC BY DEC

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"Digital's implementation of local-bus video yields outstanding results on our Graphics WinMark benchmark test."
PC Magazine, Nov. 24, 1992

PC Magazine WinMark Test

	Graphics WinMark (megapixels per second)
DECpc 450d2 LP (486DX2/50)	12.98
50-MHz 486DX2 average	5.51
Dell System 486D/50 (486DX2/50)	1.58

Higher scores represent better performance.
Source: PC Magazine Labs, PC Magazine, Nov. 24, 1992

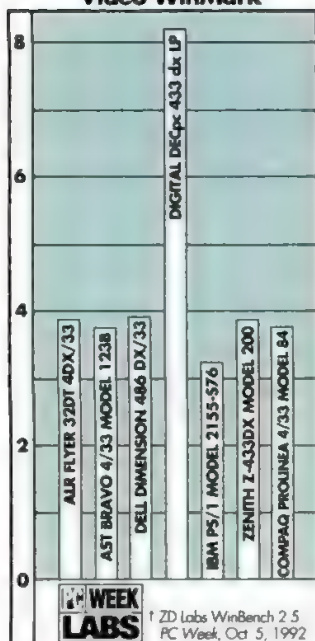
"I think they're a winner."
Andy Seybold, Associated
Press, Aug. 24, 1992

"Credible prices and service competition to new 'value-priced' computers from Compaq, Dell, and IBM."
PC Magazine, Nov. 24, 1992

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der Windows, :



Personal Finance Managers

egory information to each card purchase. This information is uploaded to customers once a month, either via modem (\$3 a month) or on-disk (\$4.50 a month). The information then plugs directly into Quicken, producing a complete record of all card purchases without the user keying in a single charge receipt.

Regardless of platform, Quicken offers intuitive financial management without the hassle of paperwork. Compared with MECA Software's Managing Your Money, Quicken is a little short on investor tools, but it still wins on overall ease of use and electronic links. And in the Microsoft Windows arena, Quicken for Windows 2.0, remains, at this writing, peerless.

Wilson WindowWare Inc.

WinCheck

WinCheck (\$69.99), from Wilson WindowWare, is a well-designed personal finance manager that, unfortunately, lives in the long shadow of Microsoft Money and Quicken for Windows. It's neither as



complete nor as friendly as these two programs, but it does handle routine banking chores with ease.

WinCheck supports three types of accounts: checking or cash, savings, and credit card accounts. Budget categories are built-in, and you can add or delete them as you wish.

When you launch the program, a series of dialog boxes helps you choose the account you want to work with or create a new account. The program shows you current balances, then launches you into the check register. From there, you can

choose any of the icons across the top of the screen for access to data entry forms, including a check to record expenses and a deposit slip to record income. There's also an on-screen ATM-input dialog box that lets you record cash machine withdrawals quickly.

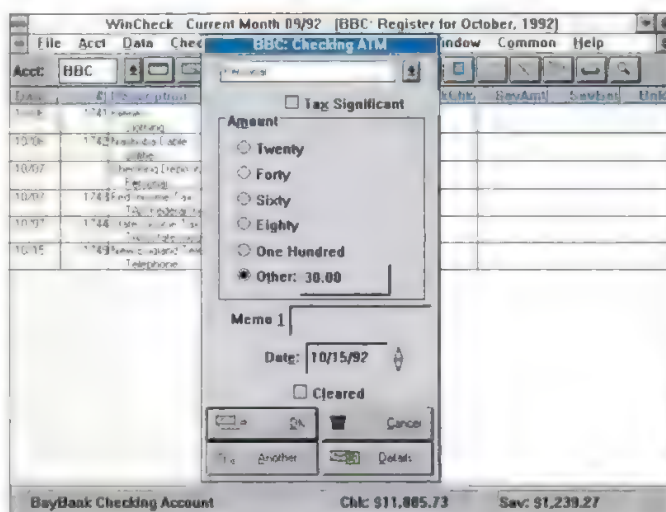
The package includes some other nice capabilities, such as the ability to schedule payments in advance and to remind you a few days before they are due. There's also a Reconciliation Helper that sorts your check register, separating out deposits at the top and debits at the bottom. This makes it easy to follow along in your bank statement as you mark cleared transactions. If your account doesn't balance, WinCheck tells you so, and then asks if you want the program to enter a transaction into your account for the amount by which you're off.

WinCheck also has a module for setting up printed check formats, although the standard templates for dot matrix and laser printing should suit most needs.

CHECK THIS

WinCheck could use some added polish in a few areas, however. For example, it doesn't automatically memorize transactions; instead, it requires that you enter recurring transactions in a list or select items from the check register to be memorized. When it's time to pay a recurring transaction, you must select it from a drop-down list. Unlike many of the other products reviewed here, WinCheck doesn't automatically fill in the memorized name as you begin to type it.

WinCheck is missing some of the sophisticated features of more complete finance managers. This is not the program to choose if you plan to track investments, as there is no portfolio manager. Nor will you find financial calculators or tax planning modules in WinCheck.



WinCheck's unique on-screen ATM is a fast, convenient way to enter automatic teller transactions.

One big advantage to WinCheck, though, is that Wilson WindowWare distributes an evaluation version of the program as shareware. You can download and try the program for the cost of the connect time from a number of on-line services, including ZiffNet. This shareware version is a great place to start

FACT FILE

WinCheck, Version 3.0p

Wilson WindowWare Inc., 2701 California Ave., #212, Seattle, WA 98116; 800-762-8383, 206-937-9335; fax, 206-935-7129

List price: \$69.99

Requires: 640K RAM, 1MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0 or later

In short: WinCheck provides a great opportunity for personal finance skeptics. Wilson WindowWare distributes the program as shareware in addition to selling it directly, so they can try it practically cost free. The program isn't as friendly as Microsoft Money or Quicken for Windows, nor is it as feature-rich, but it handles most basic banking functions with relative ease.

486 ON READER SERVICE CARD

SUITABILITY TO TASK

WinCheck

POOR FAIR GOOD EXCELLENT

Checkbook management	●	●	●	○
Budgeting	●	●	○	○
Tax and financial planning	●	○	○	○
Portfolio management	N/A			
Electronic connections	N/A			

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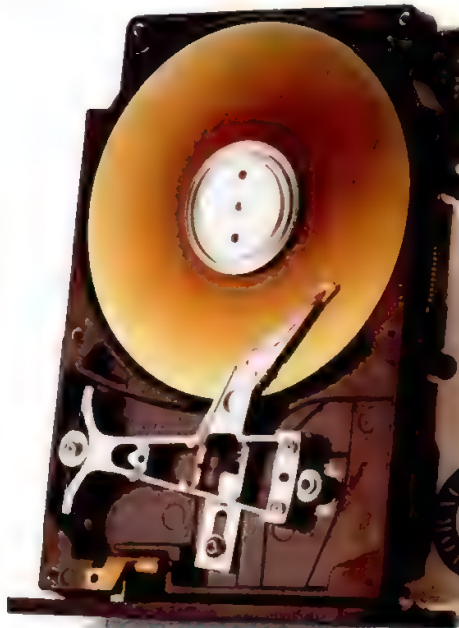
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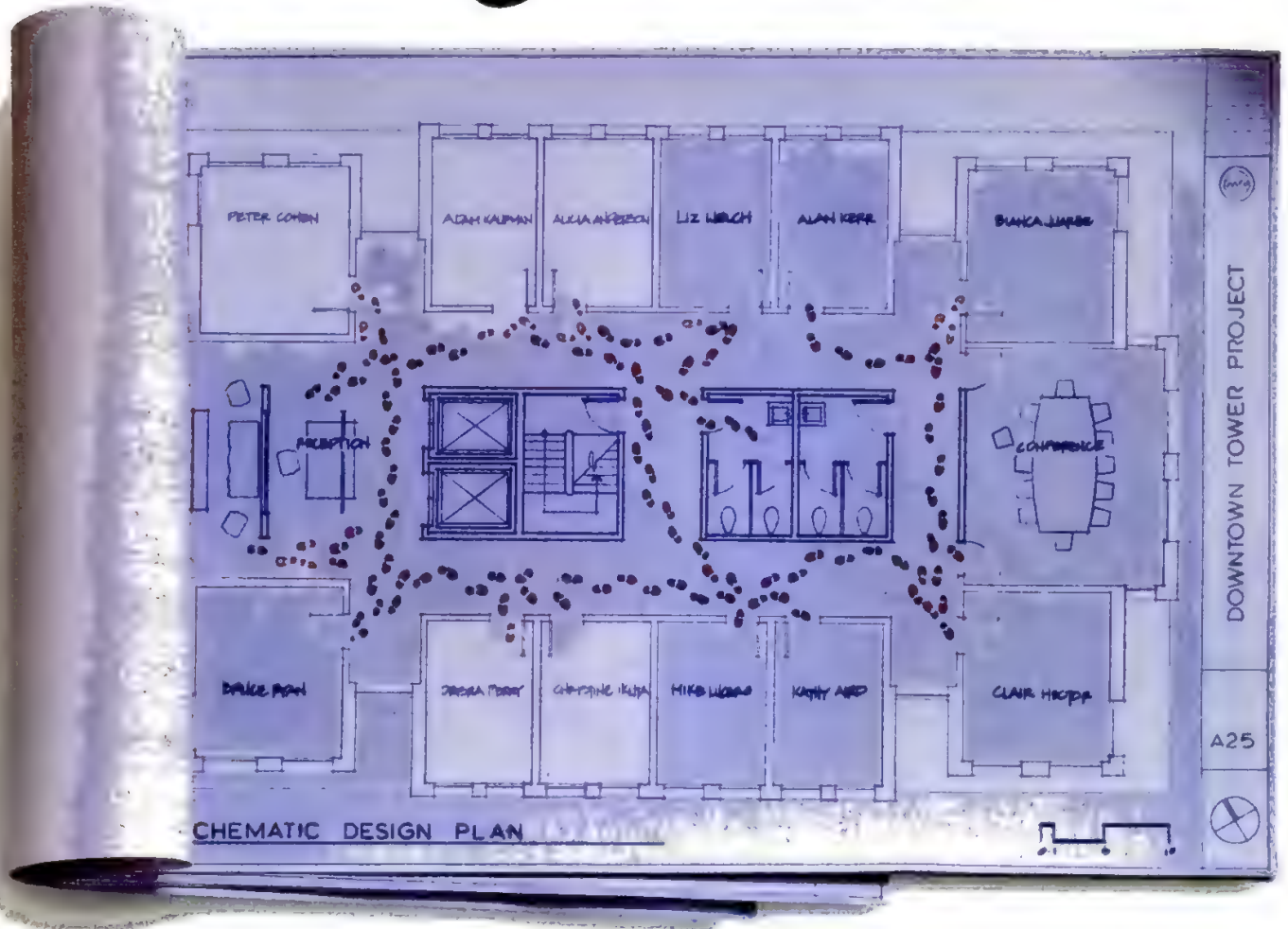
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LOW-COST ANALYZERS

An Eye into the LAN



Protocol analyzers are no longer expensive or esoteric—you can now get one for less than \$3,000. Here's a look at seven inexpensive products that can make network troubleshooting a breeze.

Zipping across your network are thousands of packets of information. Information that's vital to your corporation. Losing even some of that data can cost your company millions of dollars. But ensuring the safety of these information packets has seemed like nothing less than a black art. And unless you had thousands of dollars to spend, the necessary tools for preserving and maintaining your LAN and the data on it were beyond your reach.

Until now. Over the past 12 months, new low-cost protocol analyzers have arrived. Before these new analyzers hit the market, only high-end products that cost around \$12,000 were available. The price tag attached to the new breed of products

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by Frank J. Derfler, Jr.

Protocol Analyzers

can often be less than \$3,000.

You can use these products to search for duplicate network addresses, monitor conversations between a client and servers, isolate failing nodes, or merely get a good idea of how your network performs.

Don't be fooled, though. At less than a quarter of the price of high-end products, low-cost analyzers do require some sacrifices in functionality. While Network General Corp.'s high-end Sniffer may be able to decode roughly 140 protocols blazing across the LAN, low-cost analyzers can decode relatively few protocols (for more information on how protocol analyzers translate network information, see the sidebar, "Understanding Analyzers").

Even so, these lower-cost products may provide only limited information

about a particular packet, whereas vendors of new high-end analyzers have now enabled these products to provide detailed advice about the probable cause of problems they detect. What's more, high-end analyzers use proprietary hardware platforms to capture and analyze all network traffic under even the most stringent conditions. Low-cost analyzers, however, may capture most packets on most networks, but when traffic levels increase they will quite likely drop some frames.

High-end protocol analyzers are becoming increasingly more sophisticated in other ways as well. Many vendors have

adopted the remote monitoring (RMON) management information base (MIB), which provides a standard specification for obtaining information from remote protocol analyzers. With RMON,

you can deploy a protocol analyzer on a network in a distant sales office and gather valuable network information back in the corporate headquarters. Facilities such as this, which are tremendously helpful in managing large networks, aren't provided in low-end protocol analyzers.

Still, the less-expensive analyzers are fine for most small workgroups, which typically use only 40 to 50 percent of Ethernet's capacity and run only one or two protocols.

We look at seven such products in our roundup. All of these protocol analyzers provide a number of different functions. They let you collect and decode NetWare packets, although the level of decoding they provide varies. Some products also support AppleTalk, NetBIOS, TCP/IP (Transmission Control Protocol/Internet Protocol), or other types of network traffic. All of the products we review run on PCs, although some will work only with specific types of network adapters.

Intel Corp.'s NetSight Analyst has more functionality than any other low-cost protocol analyzer we tested. Its easy-to-use interface, its ability to translate a wide range of protocols, and the slew of predefined filters it has for that information combine to earn it the Editors' Choice distinction.

Triticom's LANdecoder/e is a close second. Although it translates a wide range of protocols, it lacks many of NetSight Analyst's filters. Because of its ability to exchange information with the Sniffer, however, LANdecoder/e is better suited than NetSight to corporations that want to distribute low-cost analyzers to their workgroup managers. Such managers can record data at several points simultaneously with the lower-priced devices, and later make detailed comparisons on the more powerful system. If you want to monitor NetWare networks, Novell's LANalyzer for NetWare

These analyzers are most appropriate for small workgroups that typically run only one or two protocols.

HIGHLIGHTS

Low-Cost Protocol Analyzers

DIAGNOSIS and troubleshooting are the main purposes of protocol analyzers. These products provide detailed data on the types of network packets traveling across a LAN. You can use the data to determine whether each node is accurately transmitting the packets across the network. You can also use many of these packages to send a set of packets over the wire as a troubleshooting procedure, to find out where any bottlenecks in your network are located.

FILTERS AND ALARMS help protocol analyzers detect particular types of network traffic. Filters sift through network traffic for particular results; precapture filters sort data on the fly, and postcapture filters sort data once it has been received by the analyzer. Alarms alert you when certain predefined thresholds have been exceeded.

THE MOST COMPREHENSIVE protocol analyzers reviewed here are Intel's NetSight Analyst and Triticom's LANdecoder/e.

THE LEAST EXPENSIVE of the prod-

ucts in our roundup is Gateway Communications' EtherStat, at \$250. Although mostly limited to lower-level NetWare protocols, this analyzer provides a good set of features for the money.

AT THE HIGH END of the protocol-analyzer scale are self-contained portable units costing thousands of dollars, typified by products such as Network General's Sniffer. These products provide more detailed data on network packets, along with interpretations of the statistics they gather.

YOU CAN SAVE MONEY by buying a low-cost analyzer that can import and export data from more-expensive devices such as the Sniffer. Triticom's \$945 LANdecoder/e is the most interoperable, since it can exchange data with the Sniffer, Intel's NetSight, and Novell's LANalyzer.

SOFTWARE-ONLY packages are often convenient for troubleshooting activity between two network nodes, but integrated hardware/software solutions are less likely to be overrun by packets under heavy network loads.



EDITORS' CHOICE

• NetSight Analyst

is the easiest product to use. Its glitzy Windows-based interface makes troubleshooting on the network a cinch. Without extensive filtering capabilities, however, LANalyzer isn't nearly as powerful as NetSight or LANdecoder/e.

SOFTWARE-ONLY ANALYZERS

LANalyzer for NetWare and the other software-only products—FTP Software's LANWatch Network Analyzer for DOS, Intel's NetSight Analyst, M-Test Equipment's Comtest NM, and Triticom's LANdecoder/e—are great for LAN administrators who need to turn a networked PC into an analyzer to solve a specific problem. The vendors of these products offer software that loads into a PC and uses a variety of Ethernet adapters to connect to the network. We used the popular Eagle Technology NE2000 adapter during our tests.

Two vendors, CXR/Digilog and Gateway Communications, contend that standard Ethernet adapters may not be able to keep up with high-volume networks. Consequently, they provide their own high-speed Ethernet adapters for their respective products, the LANVista 100EC and EtherStat.

Both of these products use the Ethernet adapter to collect network data and store the information in a RAM buffer. The size of the buffer largely determines the amount of network information the product can gather. Most of the products reviewed here support extended or expanded memory, so they can handle 2MB or more of RAM.

The LANVista 100EC is the only product that uses virtual memory and saves the buffer to disk while receiving frames. Although this might increase the number of frames you can collect, it might also cause the product to drop frames on a heavily loaded network.

USING THE ANALYZER

Since these products are limited in the amount of network traffic they can cap-

NetSight Analyst, Version 1.1, Intel Corp.'s \$995 software package, wins Editors' Choice for its terrific flexibility (it's especially adept at creating filters to find particular types of network packets). The many useful features that NetSight offers at its low

price include an interface that is straightforward, detailed on-line help, a time domain reflectometer (TDR), a cable-testing function, versatile traffic generation, Ethernet and Token-Ring compatibility, packet decoding for up to all seven layers for IP (Internet Protocol) and IPX (Internet Packet Exchange), and support for many more protocols than we can list here.

Slightly less expensive is Triticom's \$945 LANdecoder/e software. It shares many of NetSight's benefits, but it does not provide as many filters, as extensive on-line help, or a TDR, and Triticom sells Ethernet and Token-Ring versions separately. LANdecoder/e earns honorable mention, however, for its ability to exchange files with NetSight, Network General's Sniffer, and Novell's LANalyzer for NetWare. If you already own a Sniffer and want another protocol analyzer to measure traffic at other points on your network, LANdecoder/e is a good choice.

ture at any one time, extracting the right information from the network becomes critical. Most products let you sift through the data in real time, using a variety of criteria, such as Ethernet addresses and frame types. Some products let you filter traffic based on network addresses. The best products ship with extensive predefined filters. NetSight Analyst, for

Novell has another winner in its low-cost protocol analyzer line. The company's \$1,495 LANalyzer for NetWare also earns honorable mention for its easy-to-use Windows interface. LANalyzer's Dashboard window provides an excellent real-time overview of network traffic, with gauges that display packets per second, utilization percentage, and errors per second. Although its precapture filtering is limited and you cannot set triggers, the \$1,495 software product is still a strong solution for NetWare networks.

The bargain in our product roundup is Gateway Communications' \$250 EtherStat, Version 1.03. The product is particularly worth considering if you already own one of the Gateway Ethernet adapters that it requires. It does not provide extensive decoding or support for many protocols, but its useful array of statistical and alarm features makes it a good starter solution for analyzing NetWare networks.

example, provides a filter that will locate network adapters by manufacturer type. The LANVista 100EC is the only product we tested that cannot filter packets in real time.

You can also instruct the protocol analyzer to trigger a particular action when a preset threshold or condition is exceeded on the network. The products in this review typically allow you to set one or more real-time triggers. NetSight Analyst offers 15, LANalyzer for NetWare and LANWatch Network Analyzer for DOS provide three, and EtherStat lets you set two.

Once the analyzer captures a frame,

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you can display it on-screen in hexadecimal, along with an explanation in English. Depending on the products and the protocol, this on-screen explanation can range from something as simple as identifying the general category of the information packet to a detailed explanation of its function.

The amount of information returned will vary, depending on the specific product. Some low-cost analyzers, for example, might indicate a socket number in an NCP (NetWare Core Protocol) packet, while Network General's Sniffer and other high-end products like it would provide more detailed information and analysis, such as "directory attributes are Read Only."

Some packages can only receive network information, but Comtest NM, LANVista, and NetSight also let you edit and then retransmit a stream of packets. This is a useful tool, but one that might nonetheless pose a security risk. An edited rebroadcast can help find an intermittent problem stimulated by a specific event; you can replay the stimulus until you find the improper response. A rebroadcast can also open files and accounts, however, and make data available to people who might not have the authorization to access them. EtherStat, LANdecoder/e, and LANVista can also generate random network traffic. This somewhat-less-sophisticated method is still very useful when you are troubleshooting cable connections and the operation of specific LAN adapters.

Suitability to Task:

Low-Cost Protocol Analyzers

Protocol analyzers provide invaluable information about network packets. But some protocol analyzers are better than others at performing certain functions, such as finding network trouble spots and helping you manage the LAN.

Troubleshooting rates the product's ability to identify such problems as duplicate IP addresses and broadcast storms, and to provide basic information about captured frames. The ability to check the cable, generate and measure traffic, and count errors adds to the score.

Packet filtering evaluates the product's ability to set filters to capture only particular types of packets,

Understanding Analyzers

by Frank J. Derfler, Jr.

What do the U.S. Mail system and computer networks have in common? That's easy. They both pass packages between locations using a complex addressing scheme.

Detailing how a network carries its packages helps us understand how protocol analyzers work. As with the U.S. Mail, each package of data (called a frame) has a series of addresses. Those addresses reference not only the PC's particular location, but also a particular process within the computer.

A postal letter contains all of its addressing information on a single envelope; networks embed similar information in a series of layers. The technique networks use is a lot like putting a letter within a stationery envelope, then inside an interoffice envelope, then inside a courier envelope:

Each layer or protocol forms a separate packet containing unique addressing and control information.

Protocol analyzers translate a given frame by understanding these different protocols. At the most basic level, they must understand the particular media, in this case Ethernet. To translate a NetWare frame, the protocol analyzer must understand NetWare Core Protocol (NCP), Sequenced Packet Exchange (SPX), and Internet Packet Exchange (IPX). Similarly, to translate a frame under Microsoft's Windows for Workgroups or LAN Manager, NetBIOS Extended User Interface (NetBEUI) and Server Message Block (SMB) must be translated.

How well an analyzer understands these and other protocols determines its ability to translate network information. □

REVIEW CRITERIA

In this review, we look at network analyzers that cost less than \$3,000, capture NetWare frames, and run on a PC under DOS or Microsoft Windows.

A number of products did not make our filter for this feature. We ruled out ProTools' Cornerstone Agent, for example, because it is based on OS/2. Cabletron Systems' LANView Network Ana-

lyzer, Hewlett-Packard Co.'s HP Lan-Probe II, and Telecommunications Techniques Corp.'s NetLens Ethernet Analyzer were all too expensive. Azure Technologies' LAN Pharaoh for Ethernet, and Dolphin Networks' Dolphin ESP were not available in time to be included in our review. 3Com Corp. no longer sells its NetProbe utility. Network General Corp.'s Watchdog Network

SUITABILITY TO TASK				
Product Name	POOR	FAIR	GOOD	EXCELLENT
Troubleshooting	☒	☐	☐	☐
Packet filtering	☒	☒	☐	☐
In-depth analysis	☒	☒	☒	☐
Network management	☒	☒	☒	☒
File import and export	N/A			
N/A—Not applicable: The product does not perform this task.				

and sort through previously captured traffic to identify particular packet types. The product should let you set triggers and alarms for IP, IPX, NetBIOS, and other protocols.

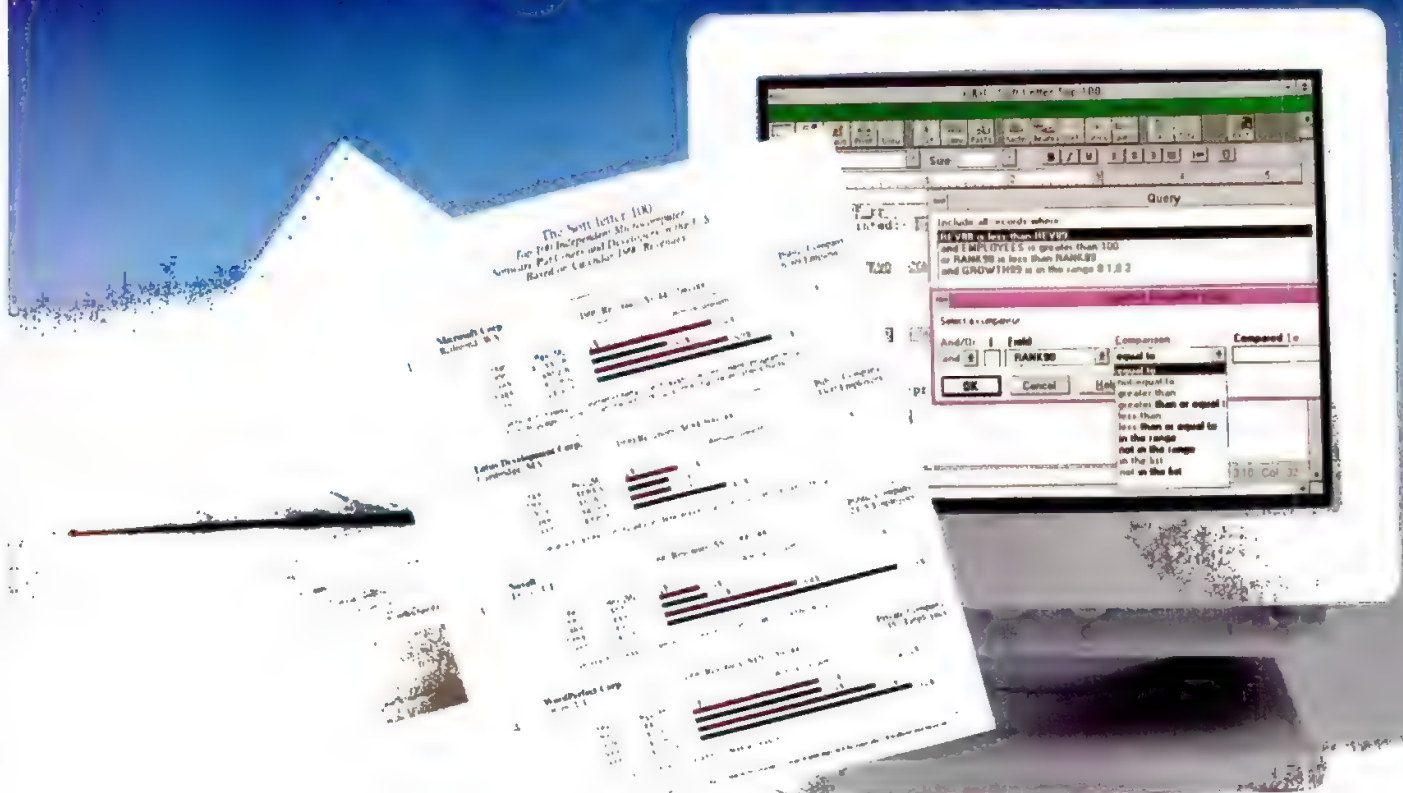
In-depth analysis rates the product's ability to pro-

vide detailed information on a network packet. The protocol analyzer should be able to display the DLC (Data Link Control), XNS (Xerox Network Services), and NCP (NetWare Core Protocol) layers. The ability to decode protocols above the transport layer adds to the score.

Network management rates the product's ability to help you manage the network and sort statistical data. The product should be able to map nodes and translate between binary and hexadecimal code, and English. It should also identify the packet transmission rate, the percentage of network utilization over time, the range of packet sizes sent, the interframe gap, and the client station that sends out the most packets over the network.

File import and export reflects the product's ability to exchange files with more expensive analyzer devices, particularly Network General's Sniffer.

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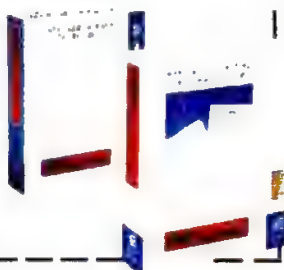
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Monitor does not capture packets, but it can monitor packet traffic (for more information on this product, see the sidebar, "Watchdog Network Monitor: Sniffer's Smaller Sibling").

SHARP TOOLS

Troubleshooting a LAN doesn't have to be like fishing in the dark. These low-cost analyzers offer all the capability that most network administrators and troubleshooters need at an affordable price. They offer enough flexibility and information to isolate many network problems. If you find you need more detailed analysis, these products can complement the operation of a more expensive analyzer. Just be sure that the product you pick supports the protocols you use on your network.

M-Test Equipment

Comtest NM

BY STEVEN C. M. CHEN

You'll have to keep a stiff upper lip if you use Comtest NM. The British-made protocol analyzer from M-Test Equipment lacks many features offered by other low-cost analyzers. It also comes with a copy-protection scheme left over from the early days of the personal computing industry.

Although the \$995 package has some good points, including a straightforward menu structure and customizable databases, it offers a small capture buffer, few statistics, and no upper-level decoding on IP and NetWare protocols.

The software-only product comes with a full set of Clarkson (now known

SUITABILITY TO TASK				
Comtest NM				
	P	R	F	E
Troubleshooting	●	●	●	○
Packet filtering	●	●	●	○
In-depth analysis	●	●	○	○
Network management	●	●	○	○
File import and export	N/A			

as Crynwr) packet drivers for network adapters. Comtest supports only a few of these free drivers, so make sure your Ethernet board is one of them. Installation is straightforward, but you must leave the program disk in your floppy drive. Comtest will prompt you if you remove it.

The menus are simple to navigate; you can use function keys for all selections and become familiar with most features in about an hour.

Capturing the right packets for troubleshooting can be tricky, though. You can't always capture enough traffic, since Comtest has one of the smallest capture buffers among our review products, about 270 packets. And you can't expand the buffer because Comtest doesn't take advantage of extended or expanded memory or offer a capture-to-disk option.

You can set up to four filters or triggers for capturing traffic, but only on the MAC address, protocol, or offset and hexadecimal data. You can use the filters or triggers in any combination but cannot save filters for later use. To prepare for an expanding network, you can generate network traffic by copying a packet from the capture buffer, loading it from disk, or creating a new packet.

Comtest's statistics on overall traffic are on the thin side, though. No detailed information is available for less than a one-minute interval, making it difficult to pinpoint when peak demand occurs. Comtest collects node statistics separately from network statistics, but gives no detail on the number of bytes transmitted and received. It does include auto-scaling bar charts for displaying

overall network performance.

Customization is available through three database files of user addresses, board addresses, and protocols. You can modify addresses within the program without exiting and loading a text editor.

Decoding is fairly complete on NetWare protocols and IP up to the transport layer, but Comtest does not support higher layers. You cannot import or export data with other high-end protocol analyzers, either.

Comtest's documentation is clear and to the point but offers no troubleshooting tips. Technical support is available through a toll-free number. But with competition such as Intel's NetSight Analyst and Novell's LANalyzer for NetWare available, you're wise to shop around before buying this product.

FACT FILE

Comtest NM

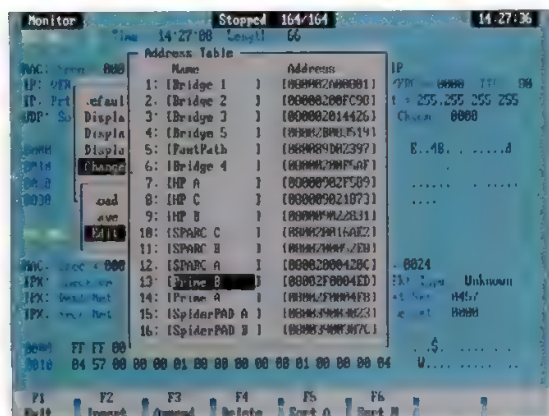
M-Test Equipment, 118 King St., #410, San Francisco, CA 94107; 800-334-4293, 415-882-4100; fax, 415-882-1988

List price: \$995

Requires: 286-based PC or better; 640K RAM. The product must be used in conjunction with any one of the following Ethernet cards: the Eagle Technology NE1000, NE2, or NE2000; the 3Com 3C501 or 3C503; the BICC AT or MCA, the EtherPLUS Elite from Standard Microsystems Corp.; the G/Ethernet 16, G/EtherTwist 16, or G/EtherTwist AT Hub Adapter from Gateway Communications.

In short: Comtest NM, a software-only product, is a solid package that provides such helpful features as easy-to-navigate menus and a customizable database. But the product does have some significant drawbacks—for example, the package offers no copy protection, limited decoding, a small capture buffer, and a high price.

 ON READER SERVICE CARD



Node	Name	Address	IP
1	Etheridge 1	08000020000001	...
2	Etheridge 2	08000020000002	...
3	Etheridge 3	08000020000003	...
4	Etheridge 4	08000020000004	...
5	Etheridge 5	08000020000005	...
6	Etheridge 6	08000020000006	...
7	Etheridge 7	08000020000007	...
8	Etheridge 8	08000020000008	...
9	Etheridge 9	08000020000009	...
10	Etheridge 10	08000020000010	...
11	Etheridge 11	08000020000011	...
12	Etheridge 12	08000020000012	...
13	Etheridge 13	08000020000013	...
14	Etheridge 14	08000020000014	...
15	Etheridge 15	08000020000015	...
16	Etheridge 16	08000020000016	...

Comtest NM presents a table showing network nodes and their addresses.

Gateway Communications Inc.

EtherStat, Version 1.03

BY STEVEN C. M. CHEN

What's an analyzer without the analysis? That's the question that Gateway Communications forces you to consider. The company's low-cost protocol analyzer, EtherStat, Version 1.03, is a good starter solution for networks. Because of the



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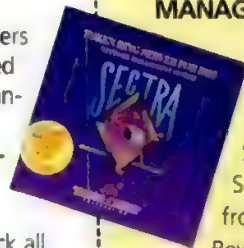
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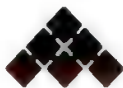


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CIRCLE 330 ON READER SERVICE CARD

■ The Short and the Long of It

Details are what differentiate low-cost analyzers. In default configuration, some products simply report the length and type of a packet while others give details that can help you troubleshoot network problems. The reports here are color-

coded to show Ethernet-LLC (Logical Link Control) information, IPX/SPX (Internet Packet Exchange/Sequenced Packet Exchange) information, NCP (NetWare Core Protocol) information, and general network information.

M-Test Equipment • Comtest NM

```
Pkt No. = 96   Time = 16:15:49   Length = 1078

MAC: Src = 00001B1534A8   Dest = 02608C416282   Length = 0428
IPX: Checksum = FFFF, Length = 0428, Trans Ctrl = 00, Pkt type = NCP
IPX: Dest Net = 00000001, Dest Node = 02608C416282, Dest Skt = 4003
IPX: Src Net = 00000008, Src Node = 000000000001, Src Skt = 0451
```

Gateway Communications Inc. • EtherStat

```
M   09:56:00.19092401 E3 043A B020      B1      0428

Type: 802.3   Length: 1064
Destination Network: 00000001 Destination Node: B1   Destination Socket: 4003
Source Network: 00000008 Source Node: 000000000001 Source Socket: 0451
IPX type: fileserv Reply Sequence Number: 9C
```

Novell Inc. • LANalyzer for NetWare

```
Packet Number : 153           2:30:16PM
Length : 1082 bytes
802.3: ----- IEEE 802.3 Datalink Layer -----
Station: 00-00-1B-15-34-A8 ----> 02-60-8C-41-62-82
Length: 1064
ipx: ----- Internetwork Packet Exchange -----
Checksum: 0x7FFF
Length: 1064
Hop Count: 0
Packet Type: 17(NCP)
Network: 00 00 00 08 ----> 00 00 00 01
Node: 00-00-00-00-00-03 ----> 02-60-8C-41-62-82
Socket: NCP ----> 0x4003

ncp: ----- NetWare Core Protocol -----
NCP Reply: Read
Reply Type: 0x1333 (Reply)
Sequence Number: 11
Connection Number Low: 1
Task Number: 1
Connection Number High: 0
Completion Code: 0 (Success)
Connection Status: 0x00
Bytes Actually Read: 1024
```

CXR/Digilog Inc. • LANVista 100EC

```
-- Start of frame 148 --

148 11:40:51.106   1078 3Com 416282 00001b1534a8 88888888 None

IEEE8023 Header
Dest Address : 3Com 416282
Source Address : 00001b1534a8
Length : 0428 (Hex)

MQVIPS Header
CRC : ffff (Hex)
Length : 1064
Transport Ctrl : 0
Packet Type : 17 (Novell Netware)
Dest Network : 1 (Hex)
Dest Node : 02608c416282
Dest Socket : 4003 (Hex)
```

Triticom • LANdecoder/e

```
Frame Time Stamp   Destination Source
-----
2 10:21:15.6686 Name?-1534A8 test
MAC 68 bytes OK CRC: 30DE0000
DLC 802.3 Len: 50
XNS (NetWare)

NCP Cmd Read File 1024 Byte(s)

MAC *** MAC Header ***
MAC
MAC Time Stamp: 10:21:15.6686
MAC Frame Length: 68 bytes
MAC Destination: 00001B1534A8 (Name?-1534A8; Novell1534A8)
MAC Source: 02608C416282 (test ; 3Com-416282)
MAC Frame Status: OK
MAC CRC: 30DE0000
MAC
DLC
DLC 802.3 Length: 50 bytes
DLC

XNS *** XNS Internet Header ***
XNS
XNS Checksum: FFFF hex
XNS Length: 50
XNS Transport Control: 00 (76543210)
XNS 00000000
XNS ||||| Hop Count
XNS ||||| Reserved
XNS Packet Type: 17 (NetWare)
XNS
XNS Dest Net: 00000008 (Name?-000008) Host: 000000000001
XNS Socket: 0451 (NetWare Server)
XNS Source Net: 00000001 (Name?-000001) Host: 02608C416282
XNS Socket: 4003 (NetWare File Server Communication)
XNS
```

```
NCP *** Advanced NetWare ***
NCP
NCP Request Type: 2222 (Request)
NCP Sequence Number: 25 Connection: 1 Task: 10
NCP
NCP Request Code: 72 (Read File)
NCP File Handle: 0100 2809 0000
NCP Byte Offset: 00000000 hex
NCP Data Length: 1024
NCP
NCP *** Normal End-of-frame ***
```


KEY

- | | |
|--|---|
| ☐ General information | ☐ IPX/SPX information |
| ☐ Ethernet and LLC information | ☐ NCP information |

FTP Software Inc. • LANWatch Network Analyzer for DOS

```

Receive time: 1.144 (+0.021) packet length: 1078 received length: 100
Ethernet: (Novll 1534a8 -> 3Com 416282) len: 0x428
LLC: ssap: ff, dsap: global Novell
IPX: xsum: 0xffff len: 1064 tc (hops): 0 packet type: 11
dst: 00000001/ 3Com 416282 socket: 4003 src: 0000000b/000000000001
socket: NCP(451)
NCP: Reply(0x3333) - unknown
sequence number: 199 connection number: 1 connection status: OK
  
```

Intel Corp. • NetSight Analyst

[Single Line Description]

```
92: 0.00160: Novell1534A8<-3Com 416282 NCP Request 147 Read File Data 010025090000
```

[Detailed Protocol Dump]

[DIX Ethernet Packet was Captured on Thu Oct 15 10:09:58.93259]

***** Ethernet Header 14 Bytes at Offset 0 *****

```

DLC:
DLC: Dest Address: Novell1534A8
DLC: Src Address: 3Com 416282
DLC: Type: 802.2 Length = (0032)
DLC:
LLC: SSAP DSAP: XNS (FFFF)
LLC: Control: 1 (00)
LLC:
LLC:
  
```

***** Novell XNS Header 30 Bytes at Offset 14 *****

```

XNS:
XNS: Checksum: FFFF
XNS: Length: 50
XNS: Trans Control: 00
XNS: Type: NCP (17)
XNS:
XNS: Dest Network: 00000008, Dest Node: 0000000000001, Dest Socket: File Server (0451)
XNS: Src Network: Main Trunk (00000001), Src Node: 3Com 416282, Src Socket: 4003
XNS:
  
```

***** Netware Core Protocol 20 Bytes at Offset 44 *****

```

NCP:
NCP: Netware Type: Request (2222)
NCP:
NCP: Sequence Number: 147, Connection: 1, Task: 10
NCP:
NCP: Request: Read File Data (72)
NCP: File Handle: 010025090000
NCP: Byte Offset: 0
NCP: Bytes to Read: 1024
  
```

[Normal End of Packet]

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SUITABILITY TO TASK

EtherStat

	POOR	FAIR	GOOD	EXCELLENT
Troubleshooting	●	●	●	○
Packet filtering	●	●	●	○
In-depth analysis	●	●	○	○
Network management	●	●	○	○
File import and export	N/A			

product's limited range of decodes, however, it provides little information about a frame's higher-level protocols.

The \$250 EtherStat, Version 1.03, is a software-only product. Installation of the package is a fairly straightforward procedure, but you are required to install a Gateway network card in the monitoring PC.

The program will work with all existing Gateway G/EtherTwist 16, G/Ethernet 16, and G/EtherTwist AT hub adapters (with older National Semiconductor chip sets). Newer versions of these boards use Fujitsu chip sets and require

an updated version of EtherStat. This new version of the product is expected to be available in early 1993.

Once the product is up and running, EtherStat's well-organized menu system is fairly simple to master. On-line, but not context-sensitive, help is available. EtherStat requires little memory, but the product cannot use extended or expanded memory, so you can't run it with any multitasking software.

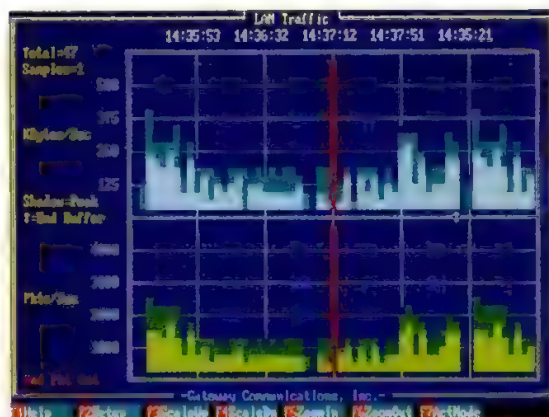
You can set precapture filters based on frame type or on a unique Ethernet address. EtherStat also lets you set alarms for excessive LAN traffic, bad packets, or undefined nodes.

You can capture packets or statistics to conventional memory or to disk after the buffer fills. No LAN traffic generator is available with the package, however.

Decoding is EtherStat's weak point. It can decode only up to NetWare's IPX (Internet

Packet Exchange) layer. Nevertheless, you should have no difficulty troubleshooting such problems as wrong frame types. But if you need to look for such upper-layer packets as NCP (NetWare Core Protocol), RIP (Routing Information Protocol), or SAP (Service Advertising Protocol), EtherStat can only indicate such a packet as an unknown IPX packet.

EtherStat can display statistics on-



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Country Day School Expels NetWare

At the Country Day School in Arlington, Texas, students get individualized computer learning at an early age. Eighteen 386 PCs are networked to share encyclopedias on CD-ROM, a raft of reading, writing, math and science software in the classroom and Windows applications in the office.

The chairman says that if NetWare were a student, it would flunk reliability. "All we could predict is that we'd have problems. We bought the latest and greatest. NetWare 3.11 was difficult to use and required constant maintenance."

So they graduated to a LANTastic network with the help of Guy Dragoo at The Productive Edge, an Artisoft Authorized Five Star™ dealer. "LANTastic does the job *better* than Novell, shares the CD-ROM with every station and can expand to 300 stations, all for 50% less," Mr. Fanning says. He gives the LANTastic network an A+.

The Country Day School board of trustees plans to add grades seven through twelve. "We're on a growth curve right now. The network has performed above and beyond our expectations. No matter how many nodes we add, our LANTastic network grows right with us," Chairman Fanning says. "We believe it's the best network out there."



THE BIG SWITCH INTERVIEW #11

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FACT FILE

EtherStat, Version 1.03

Gateway Communications Inc., 2941 Alton Ave., Irvine, CA 92714; 800-367-6555, 714-553-1555; fax, 714-553-1616

List price: \$250.

Requires: 286-based PC or better (386-based PC or better recommended); 256K RAM (640K recommended). The product must be used in conjunction with one of the following Ethernet cards from Gateway Communications: G/Ethernet 16, G/EtherTwist 16, or G/EtherTwist AT Hub Adapter.

In short: A rock-bottom price and good basic features make this software-only product hard to beat as a starter solution for a network that consists of NetWare only. You'll also need one of the Gateway Ethernet cards, however. The fact that this protocol analyzer does not support IP decoding is another potential limitation.



screen: It uses text-based graphics to give you a rough idea of network trends. You don't get the details provided by a line graph, however, and you cannot export EtherStat's data to Network General's Sniffer.

The product's documentation is not extensive, but it covers all the basics and provides troubleshooting tips as well. Technical support is available through a toll call.

Incomplete protocol decoding makes EtherStat a poor choice as a full-time protocol analyzer. It minimally monitors the network at a low cost, though, making it an excellent startup tool before you move on to a more expensive protocol analyzer.

Novell Inc.

LANalyzer for NetWare, Version 1.00

BY STEVEN C. M. CHEN

Network novices need not be intimidated by protocol analyzers any longer, thanks to Novell's LANalyzer for NetWare, Version 1.00. With its cinch-to-use Windows-based interface, complete support for NetWare and AppleTalk, and a \$1,495 price tag, LANalyzer for NetWare is a perfect protocol analyzer for small

Watchdog Network Monitor: Sniffer's Smaller Sibling

by Joe Salemi

Watchdog Network Monitor is just that: a package that monitors and provides information on network traffic.

Made by Network General Corp., which manufactures the Sniffer, the Watchdog Network Monitor doesn't exactly fit the category of protocol analyzer. But it's the more affordable alternative to the Sniffer from the company that wrote the book on protocol analyzers.

Watchdog, Version 1.04, is easy to use and provides a wealth of traffic information. But its \$1,995 price tag and its inability to capture and examine individual packets make it somewhat expensive for the features that come with it.

The Watchdog comes with a dedicated 8-bit Ethernet or Token-Ring ISA card from Racal-Interlan Corp. a main program, and a 19- to 25K terminate-and-stay-resident program. You have to load the main program to monitor the network in real time. The background TSR saves information to disk for later analysis.

The Watchdog's interface uses the same menu structure and function keys as the Sniffer's. It's a bit confusing at first, but becomes easy to use when you get accustomed to it.

While monitoring the network, the Watchdog displays a sliding bar graph of current network traffic. You can monitor traffic for the entire network, or filter traffic by the source or destination.

The Watchdog monitors and reports on 10 predefined packet types, and you can add more. The Watchdog

also transmits test packets, but only to one other station to see if that station is working properly.

As a monitor, Watchdog is a very capable performer: It keeps an eye on network traffic in several ways. You can monitor traffic for the number, type, and size of packets, and find out how much traffic a client is generating as a percentage of network capacity or of current network traffic. You can use these reports to determine if a node is using too much capacity.

The Watchdog saves traffic information in memory or in history files.

You cannot exchange these files with other analyzers, such as the Sniffer, however. The

Watchdog can produce ASCII reports (including graphs) sum-

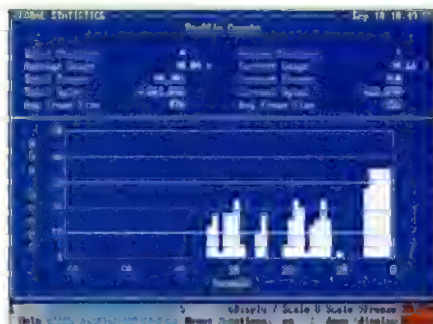
marizing the files. The product also includes several report formats that can be modified.

Network General provides a one-year warranty that includes free phone support and upgrades. Although the Watchdog provides a lot of traffic information, Network General has designed it as a low-end monitor that doesn't compete with its high-end tools. Unless you only need to find bottlenecks, you'd be better off getting a more complete package. □

Watchdog Network Monitor, Version 1.04

Network General Corp., 4200 Bohannon Dr., Menlo Park, CA 94025; 415-688-2700; fax, 415-321-0855. List price: \$1,995. Requires: 512K RAM, 355K disk space, 8-bit slot for the included card.

Circle 472 on reader service card



Watchdog Network Monitor can provide absolute and relative statistics on the number of packets the network handles and the size of the packets.

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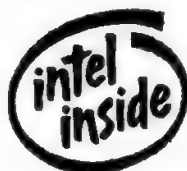
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► **S U M M A R Y O F F E A T U R E S**

Low-Cost Protocol Analyzers

The protocol analyzers that we reviewed share several features. As diagnostic tools, all can detect new nodes, measure the amount of new traffic, and count error packets. They also can display the time at which a frame was received, the destination and source addresses, the frame length, and the data header. As for reporting features, all can display a packet in English and hexadecimal, and all can trigger alarms.

Products listed in alphabetical order

■ = YES □ = NO	Comtest NM	EtherStat	LANalyzer for NetWare	LANdecoder/e	LANVista 100EC
List price	\$995	\$250	\$1,495	\$945	\$2,995
Operating environments	DOS	DOS	Windows	DOS	DOS
Network interfaces supported	Ethernet	Ethernet	Ethernet Token-Ring	Ethernet, Token-Ring	Ethernet, Token-Ring
Level of Protocol Decoding					
AppleTalk	Level 4 (included)	None	Level 7 (included)	None	Level 7 (\$1,000)
DECnet Phase IV	Level 3 (included)	None	None	None	Level 7 (\$1,000)
NetBIOS	None	None	None (included)	Level 7 (\$1,000)	Level 7 (included)
NetWare	Level 4 (included)	Level 4 (included)	Level 7 (included)	Level 7 (included)	Level 4 (\$500)
TCP/IP	Level 4 (included)	None	None	Level 7 (included)	Level 7 (\$1,000)
XNS (Xerox Network Services)	Level 4 (included)	None	Level 7 (included)	Level 4 (included)	Level 5 (\$500)
Diagnostic Features					
Transmits individual packet	■	□	□	□	■
Transmits captured buffer	□	□	□	□	□
Sends packets to assigned address	■	□	□	■	■
At controlled rate/By packet size	■ ■	N/A	N/A	■ ■	■ ■
Offers time domain reflectometer	■	□	□	□	□
Offers long-term trend analysis	■	■	■	□	■
Automatically detects duplicate addresses (MAC, network, session, transport)	■ (MAC only)	■ (MAC only)	■ (MAC only)	□	■
Generates network traffic	■	□	□	■	■
Display Features					
Time of frame transmission	□	□	□	■	■
Displays packet in binary	□	□	□	□	■
Displays packet graphically	□	□	□	□	□
User can edit captured packets	■	□	□	□	■

N/A—Not applicable: The product does not have this feature

Protocol Analyzers

(20- to 30-node) NetWare LANs.

LANalyzer for NetWare is a streamlined version of Novell's more sophisticated protocol analyzer, LANalyzer. Like the original LANalyzer, LANalyzer for NetWare lets you set alarms and triggers, capture packets, and monitor network statistics. It also stores data in a file that's compatible with LANalyzer, making it a great tool for network managers to distribute to LAN administrators across corporate networks.

Unlike LANalyzer, LANalyzer for NetWare is software-based and thus does not require specific hardware. Since it's Windows-based, you can continue to work in another application while the analyzer monitors the network.

The product's emphasis on small networks is evident in its shortcomings. Though detailed, protocol support is limited to NetWare and AppleTalk packets. Real-time filtering is also restricted; it supports only station addresses, protocol suites, and data matches. You can filter by packet type after capturing traffic, however. But you can't retransmit traffic onto the network to diagnose a problem.

WINDOWED INTERFACE

Most analyzers present an intricate array of screens and menus. Not LANalyzer for NetWare. At the outset, you work primarily in two windows: the Dashboard and the Station Monitor.

The Dashboard summarizes the condition of the network. Three gauges provide the number of packets per second, percentage of network bandwidth utilized, and the number of packet errors per second.

More information is available by clicking on the particular gauge or using the pull-down menus. Clicking on the network utilization gauge, for example, plots traffic over a 15-minute interval, in real time. You can set thresholds on each gauge. When the threshold is

exceeded, the program notifies you through audible and visual alarms.

The Station Monitor provides information about individual network stations. When LANalyzer for NetWare attaches to the server, the Station Monitor automatically compiles a table of all active stations. The information the Monitor provides includes the station's name and Ethernet address, and the number of packets the station has transmitted and received.

Filtering is limited, and no trigger can be set. LANalyzer for NetWare cannot generate any network traffic. Only station filtering, protocol suites, and data matches

can be selected. Display filterings are excellent, however, giving you the option to select packet types. Filtering can also be applied with a point and click on the captured packet. A window will pop up, allowing additional filtering.

INSTALLATION

Installation is a breeze if you use a supported ODI (Open Data-link Interface) driver. LANalyzer for NetWare will update older files and generate the necessary NET.CFG for you. It will even create a batch file that automatically loads all the drivers. ODI drivers that aren't supported must be installed manually, so be sure to obtain the correct drivers from the board manufacturer. These drivers must support promiscuous mode.

LANalyzer for NetWare will continue

SUITABILITY TO TASK

LANalyzer for NetWare

	POOR	FAIR	GOOD	EXCELLENT
Troubleshooting	●	●	●	●
Packet filtering	●	●	●	○
In-depth analysis	●	●	●	●
Network management	●	●	●	●
File import and export	●	●	●	○

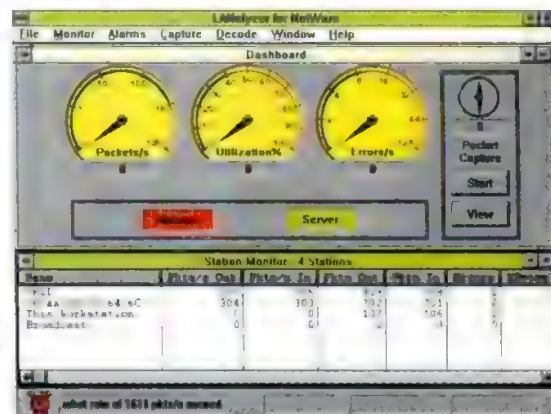
LANWatch Network Analyzer for DOS	NetSight Analyst
\$1,200	\$995
DOS	DOS
Ethernet, Token-Ring	Ethernet, Token-Ring

Level 6 (included)	Level 7 (included)
Level 6 (included)	None
Level 6 (included)	Level 7 (included)
Level 6 (included)	Level 7 (included)
Level 7 (included)	Level 7 (included)
Level 4 (included)	Level 7 (included)

☐	☒
☐	☒
☐	☒
N/A	☒
☐	☒
☐	☐
☒	☐
☐	☒

☐	☒
☐	☐
☐	☒
☐	☒

CONTINUES



LANalyzer for NetWare gives a color-coded overview of packet traffic, utilization, and errors.

NETWORKING
Protocol Analyzers

► **S U M M A R Y O F F E A T U R E S**

Products listed in alphabetical order	Comtest NM	EtherStat	LANalyzer for NetWare	LANdecoder/e	LANVista 100EC
■ = YES □ = NO					
Filter Features (Precapture)					
Number of concurrent filters	4	1	1	4	None
Type of filter:					
Source address	■	■	■	■	N/A
Destination address	■	■	■	■	N/A
Protocol type	■	□	■	■	N/A
Filter Features (Postcapture)					
Number of concurrent filters	None	1	1	1	4
Type of filter:					
Source address	N/A	■	■	■	■
Destination address	N/A	■	■	■	■
Protocol type	N/A	□	■	□	■
Predefined Filters					
ARP (Address Resolution Protocol)	□	□	□	■	□
ECHO	□	□	□	■	□
IP (Internet Protocol)	■	□	□	■	□
IP VINES	□	□	□	□	□
LAT (Local Area Transport)	□	□	□	□	□
LLC (Logical Link Control) VINES	□	□	□	□	□
NetBIOS	□	□	□	■	□
NetWare SAP (Service Advertising Protocol)	□	□	□	■	□
SNMP (Simple Network Management Protocol)	□	□	□	□	□
TCP (Transmission Control Protocol)	□	□	□	■	□
Reporting Features					
Audible/visual alarm	■ ■	■ ■	■ ■	□ □	■ ■
Boolean logic support	AND	None	AND	AND, OR, =	AND, OR
Bar charts	■	■	□	□	■
Other charts	None	None	Line charts	None	None
Real-time capture	□	■	■	■	■
File-exchange formats	ASCII, hexadecimal	None	None	ASCII, hexadecimal	ASCII, delimited
Miscellaneous					
Works across bridge or router	□	□	□	□	■
Runs on file server/PC	□ ■	□ ■	□ ■	□ ■	■ ■
Automatically creates alias names	□	□	■	□	□
User creates alias names	■	■	■	■	■
Gathers data from a remote node	□	□	□	□	□
Captures traffic to log-on disk	□	■	□	□	■
Captures traffic to log-on memory	■	■	■	□	■

N/A—Not applicable The product does not have this feature

LANWatch Network Analyzer for DOS	PC EDITOR'S CHOICE	NetSight Analyst
--	-----------------------	---------------------

Unlimited	18
■	■
■	■
■	■

Unlimited	18
■	■
■	■
■	■

■	■
□	■
■	■
□	■
■	■
■	■
□	■
■	■

■ □	■ □
AND, OR, NOT	AND, OR, NOT, <, >, =
■	□
Histograms	None
■	■
ASCII (export only)	ASCII, hexadecimal

□	□
□ ■	□ ■
□	■
□	■
□	■
■	■
■	■

ENDS

FACT FILE

LANalyzer for NetWare, Version 1.00

Novell Inc., 2180 Fortune Dr., San Jose, CA
95131; 800-243-8526, 408-473-8333;
fax, 408-435-1706

List Price: \$1,495

Requires: 16-MHz 386SX- or 486SX-based PC or better; mouse; Windows 3.0 or later. Must be used in conjunction with a Novell-certified Ethernet card and an ODI driver that supports promiscuous mode.

In short: This software-only troubleshooting tool will soon make an expert out of you—it features an easy-to-use graphical interface and instant trend analysis. But if you need IP decoding, look elsewhere.

ON READER SERVICE CARD

to monitor traffic on the network while packets are captured, displayed, and viewed. With Windows 3.1, you can even run LANalyzer for NetWare in the background while you are working on another task.

LANalyzer for NetWare's documentation is excellent and includes a section on Ethernet problems and solutions. Novell also includes a 30-minute video covering many of the program's operations and a few troubleshooting procedures. Support is mainly through resellers, but pay-as-you-go support is available through Novell. Novell's NetWare forums on CompuServe are also helpful.

To the networking veteran, LANalyzer for NetWare's graphical interface may seem unnecessary, but the interface's ease of use will be a real pleasure for less experienced troubleshooters. Add the interface to the instant trend statistics and you have a powerful networking tool that's ready for action right out of the box.

Triticom

LANdecoder/e, Version 1.11

BY PADRAIC R. BOYLE

With excellent packet decoding and high-performance drivers, Triticom's LANdecoder/e, Version 1.11, offers most of

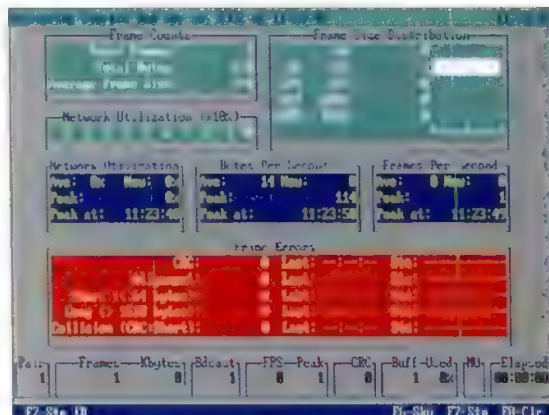
the characteristics of high-end protocol analyzers at a fraction of the price.

LANdecoder/e is inexpensive at \$945, and it is easy to install and use. Among the products in our roundup, it's also the champ at interoperability: It can exchange data with Intel's NetSight, Network General Corp.'s Sniffer, and Novell's LANalyzer. The LANdecoder/e also offers a traffic generator, excellent protocol decodes, and configurable filters. But it lacks on-line help and such useful predefined filters as duplicate IP addresses.

The LANdecoder/e, a software-only product, runs on Ethernet networks. A similar product, the LANdecoder/tr, is available for Token-Ring networks.

You can navigate through LANdecoder/e's menu choices and captured frames using arrow keys or a mouse. Each screen contains short descriptions of the active function keys; you must refer to the manual if you need more information.

LANdecoder/e offers several tools for filtering and viewing data and generating traffic. You can use Boolean logic to configure up to four filters at a time, and save



LANdecoder/e can show the frame count, the frame-size distribution, and frame errors.

them to disk. Although the program lacks a filter to test for duplicate IP addresses, we easily created our own.

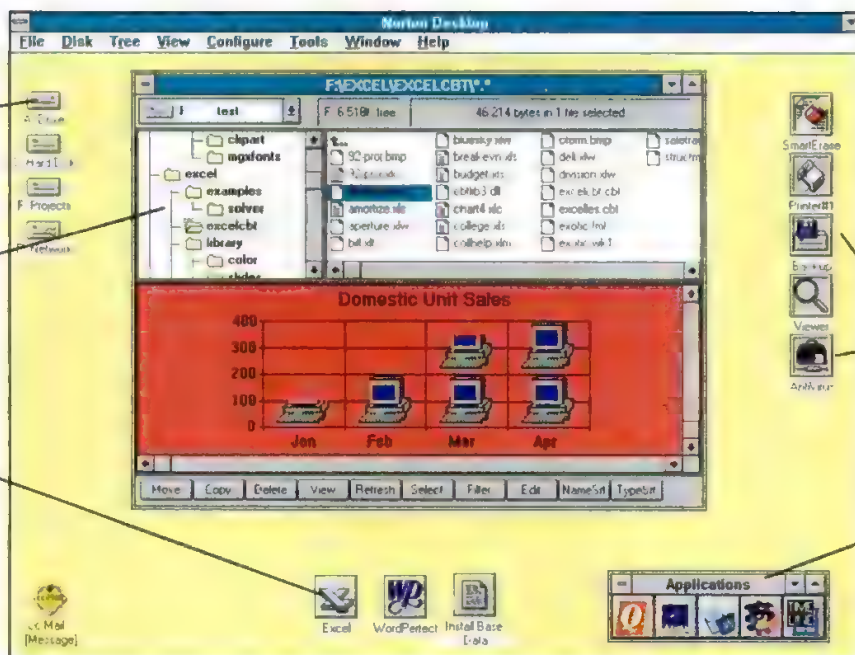
You can monitor the network from different views while LANdecoder/e captures data. The default screen monitors traffic between pairs of stations, displaying the captured data as station addresses and numerical counters. Function keys switch you to a real-time bar chart of network utilization, a look at the total frame count per second, a statistics screen, or other screens.

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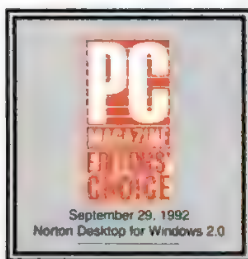
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SUITABILITY TO TASK

LANdecoder/e

	POOR	FAIR	GOOD	EXCELLENT
Troubleshooting	●	●	●	●
Packet filtering	●	●	○	○
In-depth analysis	●	●	●	●
Network management	●	●	●	●
File import and export	●	●	●	●

The statistics screen uses bar charts and numerical displays for an overall view of network activity. It shows averages and peaks and tells you when the peaks happened. You can view frame errors, their time of occurrence, and the offending card addresses. Another tool, the traffic generation utility, works between any predetermined stations to let you analyze the network under heavy load.

LANdecoder/e's packet decoding handles all seven layers of IP and IPX. If the decode information for a protocol does not fit exactly into the seven layers of the OSI model, LANdecoder/e provides the closest information it can find for each layer.

The data is simple to read and analyze. You can save captured frames to an ASCII text file in formats of varying detail and range, add user names and

addresses to simplify tracking down later problems, and import the file into other applications for further analysis.

Triticom offers free technical support, along with a 60-day warranty. A powerful, inexpensive analyzer, LANdecoder/e is a good choice for LAN managers and integrators who need maximum flexibility in creating filters and importing and exporting files.

CXR/Digilog Inc.

LANVista 100EC

BY STEVEN C. M. CHEN

Power isn't the only yardstick by which a protocol analyzer should be measured. CXR/Digilog's LANVista 100EC is a powerful low-end analyzer, but its rela-

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FACT FILE

LANdecoder/e, Version 1.11

Triticom, Box 44180, Eden Prairie, MN 55344; 612-937-0772; fax, 612-937-1998

List price: \$945.

Requires: 512K RAM. The product must be used in conjunction with any one of a number of Ethernet cards, including the Gateway G/Ethernet-A or G/Ethernet-16; the Eagle Technology NE1000, NE2000, NE2, or compatibles; the Pure Data PD18023, PD18023-16, or PDUC8023; the 3Com Etherlink II 3C503; or the SMC/Western Digital EtherCard Plus or EtherCard 16. EMS 3.2 (or higher) expanded memory recommended.

In short: For LAN integrators and managers who are looking for a low-cost analyzer that offers excellent packet decoding, Triticom's LANdecoder/e is a recommended solution. This software-only product has many of the features of more expensive, more powerful protocol analyzers and can import data from other LAN analyzer products.



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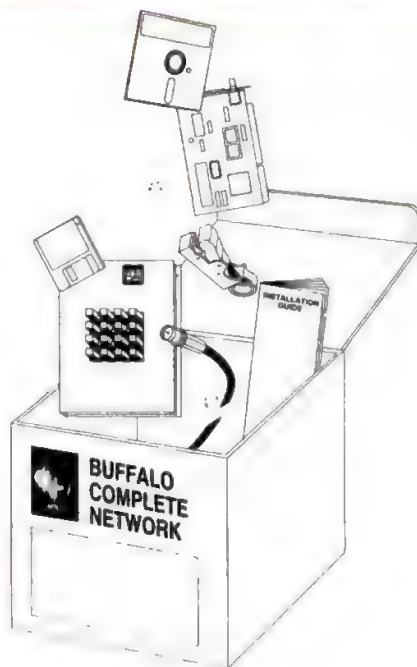
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SUITABILITY TO TASK				
	POOR	FAIR	GOOD	EXCELLENT
Troubleshooting	●	●	●	○
Packet filtering	●	●	○	○
In-depth analysis	●	●	●	○
Network management	●	●	●	●
File import and export	N/A			

tively high cost and cumbersome interface make it less than ideal for first-time users.

The basic \$2,995 package includes an ISA Ethernet board, software, and a single protocol stack of your choice. It's the only package in our group of review products that can locate cable breaks, simultaneously monitor multiple networks, provide detailed traffic statistics, and let you add other protocol stacks as well.

CXR/Digilog offers a variety of protocol stacks with the LANVista 100EC, including AppleTalk, DECnet, NetBIOS, and NetWare. A single protocol stack sells for \$1,000, except for the NetWare stack, which costs \$500.

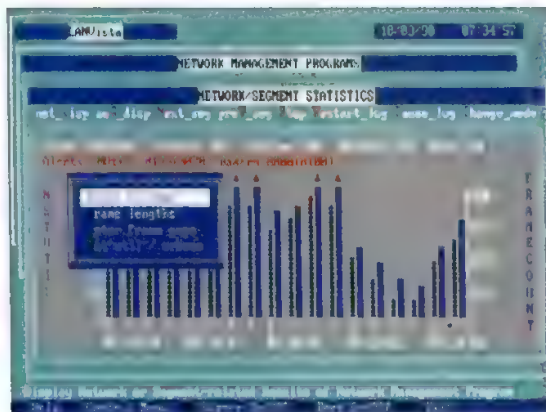
All of the protocol stacks allow you

to decode the frame up to the application layer, except for NetWare, which is limited to the transport layer. The 100EC that we used for our review came equipped with NetWare and TCP/IP (Transmission Control Protocol/Internet Protocol) stacks.

SOME DIFFICULTIES

The 100EC has a number of drawbacks. The lack of precapture filters is the first shortcoming. You have to capture all of the traffic on the network.

If precapture filters are important to you, you'll need to look at CXR/Digilog's enhanced version of the 100EC, the



LANVista 100EC generates a graph of network activity.

100ECH. This product costs \$3,495.

The 100EC is also difficult to use. Because the software works with the whole LANVista product line, the interface provides many options that aren't available on the 100EC.

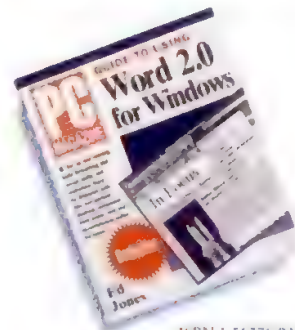
What's more, the options that are available are often buried under a myriad of menus. Finally, the program's documentation is poorly organized and lacks a chapter to help get you up and running quickly.

SOPHISTICATED TOOLS

Once you get past the cumbersome interface, the 100EC does provide some nifty troubleshooting features. For example, the cable tester will identify a cable break using a time domain reflectometer (TDR).

The LANVista 100EC can also help you plan network expansion by generating extra traffic. You can then troubleshoot by analyzing the effect of this extra traffic on the network. The program generates network statistics that report on

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FACT FILE

LANVista 100EC
CXR/Digilog Inc. (a division of CXR Corp.), 900 Business Center Dr., Horsham, PA 19044; 800-344-4564

List price: \$2,995 (for hardware and software, including choice of one protocol); additional protocols, \$500-\$1,000 (depending on protocol and level of decode); Novell and ISO levels 1-4, \$500; any four protocols, \$1,500. LANVista 100TB (Token-Ring version), \$3,495. LANVista 100ECH, \$3,495. LANVista 200, \$6,495

Requires: 286-based PC or better, 560K RAM.

In short: A powerful but complicated interface makes LANVista 100EC difficult for first-time users. An experienced network administrator with a multisection network will find this hardware/software combination useful, but the lack of high-level NetWare decoding can be a problem.

495 ON READER SERVICE CARD

Protocol Analyzer Troubleshooting Tips for NetWare and TCP/IP Networks by Jeffrey L. Carrell and James M. Reason

Problem	Protocol	Severity	Frequency	Method of Discovery	Resolution
Duplicate network addresses cause router configuration errors on the server console.	IPX	High	Medium	Monitor broadcasts, view packets for each server, and verify the network number in the Routing Information Protocol (RIP) decode.	Make sure all server cards have unique addresses, all cards on the same LAN have the same address, and cards on different LANs have different addresses.
An old file server cannot be accessed after a new server is brought onto the network.	IPX	High	Medium	Monitor broadcasts, view packets for each server, and verify the network address in the Service Advertising Protocol (SAP) decode.	Make sure each file server has a unique internal network address.
A new file server cannot be accessed on the network.	IPX	High	Low	Monitor broadcasts, view packets for each server, and verify the service name in the SAP decode.	Make sure each file server has a unique service name.
Clients cannot communicate with a specific file server on a multiserver network.	IPX	Medium	Medium	Monitor broadcasts, view packets for each server, and verify the network number in the RIP decode.	Make sure each file server's network interface card has a unique network address.
Excessive service advertisements occur on the network.	IPX	Medium	Low	Monitor broadcasts, view packets for each server, and verify the service names in the SAP decode.	Reduce the SAP devices via SAP filtering on a router, or upgrade to NetWare 3.x if you are running 2.x.
Client station cannot work with e-mail.	IPX	Low	Low	Monitor network for packets sent to or from the station; watch for lack of responses to requests.	Increase the Abort, Listen, or Verify time-out values for SPX and NetBIOS in the station's SHELL.CFG file.
BOOTP request gets no response from the server on the same network.	IP	High	High	Monitor LAN for packets sent to and from the boot requester and watch for missing responses.	Make sure server is set for BOOTP, server's configuration database is properly set, and the database references only files that do exist.
Wrong or invalid IP address for local subnetwork, or incorrect subnetwork mask.	IP	High	Medium	Monitor session between client station and host and watch for lack of response to requests.	Make sure hosts on the same subnetwork have the correct subnetwork mask configurations and are attached to the appropriate segments.
IP addresses are being duplicated.	IP	Medium	Medium	Capture packets filtered on the suspect IP address.	Be sure each station (host) has a unique IP address.
A session has been dropped.	IP	Medium	Low	Monitor the session, looking for disconnect requests.	Check for router interface resets, incorrect software configuration on the server, and an expired inactivity timer.
BOOTP fails, though TFTP (Trivial File Transfer Protocol) files can be downloaded between networks across a router.	IP	Low	Low	Monitor network for packets sent to and from the boot requester if BOOTP requests get no answer.	Make sure router can support forwarding of BOOTP broadcasts. Otherwise, you may need to use TFTP for downloads.
File transfers are interrupted, or the same data is requested or retransmitted many times.	IP	Low	Low	Monitor network for packet missing from sequence or retransmission request for midsequence packet.	Check for hardware, bridge, or media fault, insufficient receive buffers, or a lost packet in the remote collision domain.
Excessive network traffic from router redirects.	IP	Low	Low	Monitor for IP packets with a Time-to-Live (TTL) value of 1 or 0 (soon to be discarded).	Remove routing loops by eliminating alternative communications paths.
Broadcast storm occurs on a multiprotocol network.	Any network protocol	High	Low	Set capture filters on various types of broadcasts, such as DECnet, IP, NetWare, VINES, XNS.	Check the cabling, protocol configuration, and network card.
Response time or throughput is slow.	Ethernet	Medium	Medium	Monitor network in promiscuous mode (without filters) to determine the bandwidth utilization and error rate.	Check for faulty media or hardware and Ethernet saturation. You may need more server cards or servers to handle the load.
Excessive collisions occur.	Ethernet	Medium	Low	Monitor the network, capturing all error packets, including fragments if possible.	Check any station that seems to have a defective receive circuit or inadequate collision-sense circuit.
Line and burst errors and transmission aborts occur.	Token-Ring	Medium	High	Monitor traffic, capturing all ring-error monitor MAC (media access control) frames.	Check the error report's NAUN (next active upstream neighbor) field. It will identify the source of errors.
The ring-error monitor reports receiver congestion.	Token-Ring	Low	Medium	Monitor network in promiscuous mode to determine the bandwidth utilization and error rates.	Check for a hardware fault that causes an interface on the ring to run out of receive buffers.

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Protocol Analyzers

such features as network utilization, the frame count over time, the frame-size distribution, the interframe gap, and network errors.

Although it does not support precapture filters, the 100EC does allow you to filter frames once they've been received. Those filters can be linked using AND or OR Boolean operators.

The packets captured in the 100EC's buffers are always saved to disk on the fly for instant viewing. Because of this, the 100EC might drop some frames if it runs on a slow PC that is attached to a busy network. A RAM disk or a faster PC can relieve this problem. You can also export the data to an ASCII file, but you cannot export the data to any other high-end protocol analyzer.

Despite its high-powered features, the LANVista 100EC's difficult interface makes it less attractive for small LANs. It may be appropriate for larger networks needing multiple-segment monitoring options, however.

FTP Software Inc.

LANWatch Network Analyzer for DOS, Version 2.04

BY JOE SALEMI

Not all low-end analyzers are targeted at the network manager. Some products, such as FTP Software's LANWatch Network Analyzer for DOS, Version 2.04, take careful aim at the developer commu-

nity and fall short on the ease-of-use features network managers may need.

The \$1,200 software-only product offers weak IPX decodes but is strong on

handling TCP/IP packets. It includes analyzer source code that developers can modify to monitor their own protocols. LANWatch's interface, however, is entirely character-based, even in its graphs, with confusing one-line menus and minimal on-line help. Version 3.0—in

beta testing during this review—resolves some of these problems but is still primarily a developers' tool.

LANWatch comes in different versions for particular Ethernet cards and in a generic version for nonsupported cards, including Token-Ring. The current version doesn't support expanded or extended memory and so is limited in the number of packets it can receive; Version 3.0 adds EMS support.

The main interface is a display showing basic, color-coded information on each captured information packet. The bottom of the screen provides a one-line function menu. You enter commands by typing a single, case-sensitive character.

You can examine packets in a split-screen view, with header information on top and ASCII and hexadecimal contents below. The contents view can be scrolled but not edited. LANWatch can fully decode up to the transport layer and supports six different filters. You manually enter the characteristics at a one-line prompt and use AND or OR Boolean commands for more precision.

LANWatch is not long on filter flexibility. Changing the filter during a session requires deleting the previous filter. You can't save filters to disk, and have to reenter them whenever you use the product. (According to FTP representatives, Version 3.0 fixes the latter problem). LANWatch includes filters for most common protocols except NetBEUI (Net-

FACT FILE

LANWatch Network Analyzer for DOS, Version 2.04

FTP Software Inc., 2 High St., North Andover, MA 01845-2620; 508-685-4000; fax, 508-794-4477

List price: \$1,200.

Requires: 386-based PC or better; 384K RAM; any Ethernet or Token-Ring card compatible with an NDIS driver

In short: LANWatch, FTP Software's software-only product, gives the network manager complete details on the contents of some network packets, making it helpful for in-depth analysis; moreover, its inclusion of source code makes it an ideal package for protocol developers. LANWatch is not, however, the best choice for general use. It offers a rather primitive interface (especially when compared with other packages in this roundup), and it lacks many common analysis features.



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BIOS Extended User Interface). It can monitor NetBIOS packets only if they're encapsulated in a supported protocol.

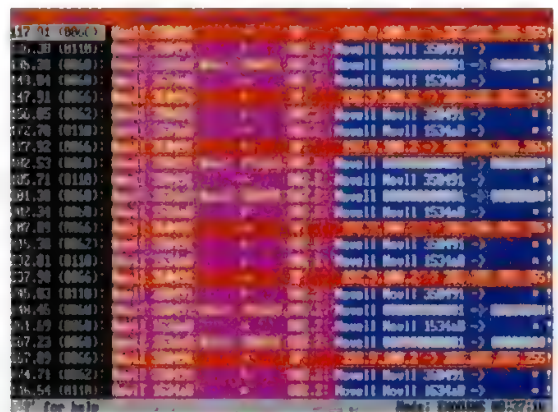
LANWatch is essentially limited to displaying packet type and header information. It does not analyze, but rather leaves interpretation of the packet's data to the user. LANWatch is also a passive analysis tool. It cannot transmit new or edited packets. And you can capture packets to disk, but you cannot exchange them with other analyzers. Separate utilities create full or summary reports on disk captures.

FTP includes LANWatch's source code, so developers can extend it to filter their own protocols. Full information on the capture file format is also included for

SUITABILITY TO TASK

LANWatch Network Analyzer for DOS

	POOR	FAIR	GOOD	EXCELLENT
Troubleshooting	●	●	○	○
Packet filtering	●	●	○	○
In-depth analysis	●	●	●	○
Network management	●	○	○	○
File import and export	N/A			



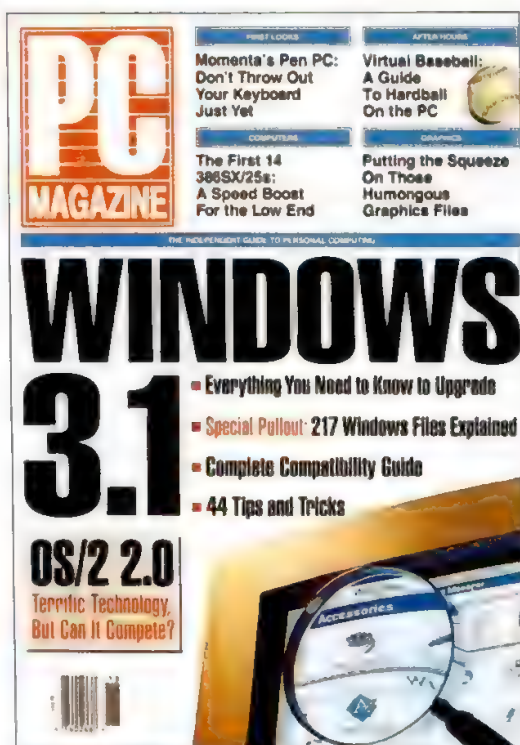
LANWatch Network Analyzer for DOS uses color coding to flag particular protocols.

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developers' reporting programs.

Version 3.0 adds support for more protocols, including NetBEUI, and it can save filters to disk. On-line help is more extensive, and you can choose filters from lists instead of typing them in. LAN-Watch's warranty provides only a 90-day return policy and bug fixes; one more sign of its developer orientation.

Intel Corp.

NetSight Analyst, Version 1.1

BY PADRAIC R. BOYLE

If you could describe the perfect analyzer, what characteristics would you include in your description? Excellent packet decoding? Lots of default filters? Rich protocol support? Intel's got a protocol analyzer that has all those features, plus ease of use, and they are all available at a decent price.

NetSight Analyst, Version 1.1, packs a high-powered protocol analyzer into a \$995 box. Sixty simultaneous filters, full seven-layer decode of AppleTalk, NetWare, and TCP/IP protocols, Ethernet and Token-Ring support, an elementary time domain reflectometer (TDR) for identifying cable breaks, and the ability to generate traffic are some of the highlights of NetSight Analyst. If there is a drawback, it's that you cannot exchange captured data with other protocol analyzers.



NetSight Analyst provides detailed information about the packets it captures.

NetSight Analyst is Intel's software-only version of its NetSight Professional, a package that is the company's answer to the Sniffer. Intel also makes NetSight Sentry, a set of traffic-flow analysis tools.

NetSight Analyst provides an easy-to-follow interface. Arrow keys navigate you through menus and captured data. Detailed on-line help is available for each screen, though the help is not context-sensitive.

The program offers something the other software-only analyzers do not: a TDR that alerts you to any cable breaks and tells you how far away they are. The TDR works with Ethernet cards whose drivers support the TDR function, including Intel's EtherExpress and PCLink cards.

To detect a network bottleneck, you can broadcast packets or transmit them to a specific address. You can also choose a packet from the template list, edit the contents before sending it, add captured packets to the template list for later reuse, or retransmit them directly from your capture buffer.

NetSight Analyst offers four filter types—capture, trigger, display, and alarm—that you can configure to cover just about any criterion. Each filter supports Boolean AND, NOT, and OR operators, and filters can be used simultaneously for greater precision. You can save and reuse filter sets at any time, or design your own filters.

NetSight Analyst cuts down the clutter after capturing a mass of packets by letting you choose packets to view while hiding others. You can also assign alias names to card addresses to simplify network management, and the program can automatically link user names with Ethernet addresses.

The program's packet decoding doesn't leave out a thing. With output similar to the Sniffer's, it breaks down packets to all seven layers for AppleTalk, NetWare (IPX/



FACT FILE

NetSight Analyst, Version 1.1

Intel Corp., 5200 N.E. Elam Young Pkwy., Hillsboro, OR 97124-6497; 800-538-3373, 503-629-7000; fax, 800-458-6231; fax back, 800-525-3019

List price: \$995

Requires: 286-based PC or better. 2MB expanded memory and 580K conventional memory recommended.

In short: Intel's software-only NetSight Analyst provides good protocol decoding for LANs of most sizes at an affordable price. It comes with a wide variety of filters and driver support

ON READER SERVICE CARD

SPX), and TCP/IP; presents data in hexadecimal; and provides the address, destination, packet type, source, and socket number. If a protocol stack does not neatly map into the OSI model, NetSight approximates that mapping for each layer. (For more information on the OSI model, see "LAN Fundamentals, Part 2," *PC Magazine*, April 14, 1992).

Like Triticom's LANdecoder/e, NetSight goes beyond identifying packets to give you NCP (NetWare Core Protocol)

NetSight Analyst offers four filter types—capture, trigger, display, and alarm—that you can configure to cover just about any criterion.

information, such as file and directory attributes. You can save data to an ASCII file for import into other programs (but not Lotus 1-2-3 or Microsoft Excel) or print it.

Intel provides clear documentation and technical support through BBS, CompuServe, and two-way fax. Phone support costs \$30 per call. If you need an analyzer for viewing network traffic, trapping specific errors, locating bottlenecks, and creating a TDR, NetSight Analyst does it all at an attractive price. □

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Easy Key Redefinition

Keeping Count

BY NEIL J. RUBENKING

EASY KEY REDEFINITION

I often need to set up macros (ANSI key redefinitions) in the DOS environment, so I created a batch file and a BASIC program in order to handle the task automatically. SETMACRO.BAT

```
QBASIC /RUN SETMACRO
COMMAND /C SET MCRO
DEL SET_MCRO.BAT
```

calls SETMACRO.BAS (Figure 1), which asks you to enter a command and a shortcut key you want to associate with the command, and then creates a temporary batch file that uses the DOS PROMPT command to set the shortcut key to the desired command. Control then returns to SETMACRO.BAT, which runs and then deletes the temporary batch file.

Note that if you don't enter a command when the BASIC program requests

one, the keystroke you type in will return to its normal definition. And, of course, to use this technique, you need to make sure that you've included the command DEVICE=ANSI.SYS in your CONFIG.SYS file.

Aaron Kardell
Wayne, Nebraska

► **PC MAGAZINE:** DOS's ANSI.SYS driver provides the capability to redefine keystrokes, but to redefine the keys that really make sense, like Alt-X or Ctrl-F10, you have to look up obscure scan codes. The logical approach, of course, is to let your computer handle that job for you. I modified the SETMACRO.BAT file to call DOS 5.0's QBASIC; if you're using an older version of DOS, change QBASIC /RUN to BASICA, or GWBASIC, or whatever is right on your system.

SETMACRO.BAS simply reads the key you pressed and generates an appro-

priate ANSI keyboard redefinition command in the temporary file SET_MCRO.BAT. The batch file SETMACRO.BAT runs the BASIC program, then uses COMMAND /C to execute the temporary batch file. Yes, DOS versions 3.3 and later include the CALL command to execute other batch files, but in this case COMMAND /C makes more sense. Any changes to the environment made by a batch file executed with COMMAND /C are *lost* when the batch file ends, so there's no need to include code that will save and restore your original PROMPT.

Unfortunately, contrary to the text above, the original SETMACRO.BAS program is not actually able to *remove* the macros it creates. When you press the key whose redefinition you want to remove, ANSI takes over, and the BASIC program receives the redefinition string, *not* the keystroke you pressed. I wrote a somewhat streamlined version, SETMACR2.BAS, which is shown in Figure 2. This program creates the command to undo a keyboard redefinition at the same time that it actually performs the redefinition. The undo command is appended to the file UN_MCRO.BAT, and the batch file UNMACRO.BAT shown in Figure 3 executes UN_MCRO.BAT and then deletes it. You may want to modify SETMACR2.BAS to put the UN_MCRO.BAT in a particular location, perhaps your batch file directory.

SETMACRO.BAS

Complete Listing

```
5 INPUT "TYPE IN COMMAND"; D$
7 PRINT "TYPE IN SHORT-CUT KEY"
10 A$ = INKEY$: IF A$ = "" THEN 10
20 B$ = MID$(A$, 1, 1)
30 C$ = MID$(A$, 2, 1)
40 FOR I = 0 TO 255
50 IF B$ = CHR$(I) THEN B$ = STR$(I)
60 NEXT
70 FOR I = 0 TO 255
80 IF C$ = CHR$(I) THEN C$ = STR$(I)
90 NEXT
100 B$ = MID$(B$, 2)
110 C$ = MID$(C$, 2)
120 OPEN "O", #1, "set_mcro.bat"
130 IF C$ = "" THEN IF D$ <> "" THEN PRINT #1, "PROMPT $e[" +
B$ + ";" + CHR$(34) + D$ + CHR$(34) + ";13p"
140 IF C$ <> "" THEN IF D$ <> "" THEN PRINT #1, "PROMPT $e[" +
B$ + ";" + C$ + ";" + CHR$(34) + D$ + CHR$(34) + ";13p"
150 IF C$ = "" THEN IF D$ = "" THEN PRINT #1, "PROMPT $e[" +
B$ + ";" + B$ + "p"
160 IF C$ <> "" THEN IF D$ = "" THEN PRINT #1, "PROMPT $e[" +
B$ + ";" + C$ + ";" + B$ + ";" + C$ + "p"
170 CLOSE #1
180 SYSTEM
```

Figure 1: This BASIC program creates a temporary batch file that uses ANSI commands in the PROMPT to redefine a keystroke.

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SETMACR2.BAS

Complete Listing

```

10 INPUT "TYPE IN COMMAND"; D$
20 IF D$ = "" THEN 10
30 PRINT "TYPE IN SHORT-CUT KEY"
40 A$ = INKEY$: IF A$ = "" THEN 40
50 B$ = MID$(A$, 1, 1)
60 C$ = MID$(A$, 2, 1)
70 B$ = STR$(ASC(B$))
80 C$ = STR$(ASC(C$))
90 B$ = MID$(B$, 2)
100 C$ = MID$(C$, 2)
110 OPEN "O", #1, "set mcro.bat"
120 IF C$ = "" THEN PRINT #1, "PROMPT $e[" + B$ + ";" + CHR$(34) +
D$ + CHR$(34) + ";13p"
130 IF C$ <> "" THEN PRINT #1, "PROMPT $e[" + B$ + ";" + C$ + ";" +
CHR$(34) + D$ + CHR$(34) + ";13p"
140 CLOSE #1
150 OPEN "un mcro.bat" FOR APPEND AS #1
160 IF C$ = "" THEN PRINT #1, "PROMPT $e[" + B$ + ";" + B$ + ";13p"
170 IF C$ <> "" THEN PRINT #1, "PROMPT $e[" + B$ + ";" + C$ + ";" +
B$ + ";" + C$ + ";13p"
180 CLOSE #1
190 SYSTEM

```

Figure 2: A variation on the SETMACRO program, this program creates the command to undo each ANSI keyboard redefinition it creates.

UNMACRO.BAT

Complete Listing

```

@ECHO OFF
IF NOT EXIST UN_MCR0.BAT GOTO None
COMMAND /C UN_MCR0.BAT
DEL UN_MCR0.BAT
GOTO End
:None
ECHO Could not find UN_MCR0.BAT
:End

```

Figure 3: This batch file executes the batch lines created by SETMACR2.BAS; these batch lines restore the original meaning to the redefined keys.

KEEPING COUNT

I regularly log on to a BBS and download mail automatically, using a batch file and a timer utility to run the process unattended. This particular BBS forces callers to change passwords every 50 calls, so at some point my automatic log-in fails and the call doesn't go through. Because of the way my log-in process was automated, I had no way of knowing that the log-in had failed; it just appeared as if there were no new mail. Eventually, I realized I needed a continually updated display of the number of calls I'd made to the BBS so I could log-on manually after 49 calls and change my password.

The problem seemed simple enough: I would need one batch file that would count how many times I ran another. The count should be stored in a file, updated each time the other batch file was run, and displayed on the screen as a reminder. I decided to tackle the job myself

and here are my results.

Two small ASCII files are required to run COUNT.BAT (Figure 4). The file CALL_NUM initially contains just one line with the number 0 in it; the file INCR is identical except that it contains the number 1. When COUNT.BAT runs, it appends the INCR file to the end of CALL_NUM. After the first time, CALL_NUM has two lines, one containing 0 and one containing 1. Each subsequent use of COUNT.BAT adds another line containing a 1 to CALL_NUM.

COUNT.BAT uses the DOS command FIND to count the number of lines containing the string 1. This result is redirected into the file NEWCOUNT, which is then displayed by the TYPE command. Each time COUNT runs, another line is added to CALL_NUM and the count reported by FIND is incremented.

Keeping track of BBS calls is only one way to use COUNT.BAT; I'm sure read-

ers have other computer processes that need counting. Although the procedure I've outlined works, I'm not too happy that four files are required. Perhaps you can suggest some improvements.

Bernie Hill

Lethbridge, Alberta, Canada

►**PC MAGAZINE:** To create the original CALL_NUM file for COUNT.BAT, you can use the command

```
ECHO 0 > CALL_NUM
```

Similarly, use

```
ECHO 1 > INCR
```

to create the INCR file. If you ever want to restart the count from 0, just type the first line again.

Using FIND to count the lines in a file is clever, but Mr. Hill raises a valid concern about the number of ancillary files required by COUNT.BAT. After a bit of cogitation, I wrote COUNT1.BAT, shown in Figure 5. COUNT1.BAT only requires the CALL_NUM data file and creates it on the fly if necessary. This convenience is gained somewhat at the expense of clarity: COUNT1.BAT is harder to understand than COUNT.BAT. Let's go through it line by line.

The action starts at the third line, which checks to see if the first command line parameter is a single zero and, if so, deletes the CALL_NUM file. So just enter COUNT1 0 any time you want to restart the count. The next batch line appends a line containing the digit 1 to the CALL_NUM file. If the file doesn't yet exist, this line creates it.

Next, as in COUNT.BAT, a call to the FIND command counts the number of lines in CALL_NUM that contain the number 1. Normally FIND would list the

COUNT.BAT

Complete Listing

```

@ECHO OFF
REM COUNT.BAT - counts number of times it's executed
REM Requires file call_num., initially containing just
REM one line with the number 0. Requires file incr.,
REM containing just one line with the number 1.
COPY call_num. + incr. > NUL
FIND /c "1" call_num. > newcount.
TYPE newcount.

```

Figure 4: This simple batch file uses the FIND command's /C switch to keep track of how many times it has been executed.

matching lines, but the /C switch on the command line causes it to report only the *number* of matching lines. The result of the FIND command's search is redirected into the file NEWCOUNT.BAT; it will look something like this:

```
----- C:\BAT\CALL_NUM.: 5
```

COUNT1.BAT takes advantage of the fact that the FIND command's output always begins with ten dash characters. It redirects the output of the command ECHO SET count=%2 into a file named -----.BAT. When DOS processes this batch line, it replaces the double percent sign with a single percent, so the file -----.BAT winds up containing the command SET count=%2.

COUNT1.BAT now uses CALL to execute NEWCOUNT.BAT. When DOS executes the single line of NEWCOUNT.BAT, it takes the initial ten dashes to be the name of a program or batch file. Only the first eight dashes are significant, so the file -----.BAT gets executed. The first parameter passed to

COUNT1.BAT

Complete Listing

```
@ECHO OFF
REM COUNT1.BAT - counts number of times it's executed
IF '%1'=='0' DEL C:\BAT\CALL_NUM.
ECHO 1 >> C:\BAT\CALL_NUM.
FIND /C "1" C:\BAT\CALL_NUM. > C:\BAT\NEWCOUNT.BAT
ECHO SET Count=%2 > C:\BAT\-----.BAT
CALL C:\BAT\NEWCOUNT.BAT
DEL C:\BAT\NEWCOUNT.BAT
DEL C:\BAT\-----.BAT
ECHO Current count is %count%
```

Figure 5: This more sophisticated cousin of COUNT.BAT (Figure 4) also counts the number of times it's been executed, but without the need for so many ancillary files.

this batch file is C:\BAT\CALL_NUM., and the second is the number of lines in CALL_NUM that contain the digit 1. NEWCOUNT.BAT sets the environment variable Count to this second parameter.

After calling the temporary batch file NEWCOUNT, COUNT1 deletes it, along with -----.BAT. The current count is stored in the environment variable Count; COUNT1's last act is to display the value of that variable. You can

CALL COUNT1.BAT from within another batch file and use a simple IF test afterward to take action based on the value of the environment variable Count. (You can download these files from the Utilities/Tips Forum on PC MagNet archived as SETMAC.ZIP.) □

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Exploring the DOS Environment

BY JEFF PROSISE

Most everyone has some familiarity with the DOS environment—at least enough to know that it stores special variables such as PATH and PROMPT (along with their settings) and that, if a batch file uses too many environment variables, running it will result in an “Out of environment space” message. But real understanding of what the environment is, where it’s located, and how it’s used can be elusive. So in this issue, we’ll explore this important but often overlooked component of DOS.

WHAT IS THE ENVIRONMENT? Physically, the environment is a block of memory that stores *environment strings*, which DOS makes available to all programs, and which take the following form:

```
VariableName=String
```

where *String* represents ASCII text to which programs refer using the name you substitute for *VariableName*—the *environment variable*. Although the term *environment string* actually encompasses the entire expression above, while *environment variable* means only the portion to the left of the equal sign, the two terms are often used interchangeably.

The SET command creates, edits, and deletes environment strings, thus

```
SET MONTH=FEbruary
```

either creates an environment variable named MONTH, assigning the string FEBRUARY to it or, if MONTH already exists, replaces the current string with the new one (FEBRUARY, in this case). The command

```
SET MONTH=
```

deletes the entire environment string referenced by MONTH.

DOS capitalizes variable names entered with SET, but not characters to the right of the equals sign. If you type the line

```
set month=february
```

for example, then type SET (which lists the current environment strings), you’ll see the line

```
MONTH=february
```

SET is also one of the few DOS com-

You may already know a little about the DOS environment, but here’s an explanation of how it works, how DOS and programs use it, and where it is located.

mands that does not ignore space characters. Entering

```
SET MONTH =FEBRUARY
```

creates an environment variable with a name six characters long—the letters M, O, N, T, and H followed by a space. You can’t delete this variable by typing SET MONTH=. Instead, you must type SET MONTH = so the variable names match exactly.

DOS commands other than SET add strings to the environment—PATH, PROMPT, and APPEND (if you start it

with the /E switch), for example. Also, COMMAND.COM automatically creates an environment variable, COMSPEC, which it sets equal to its own (COMMAND.COM’s) location on-disk, allowing the command processor to reload itself if necessary.

As mentioned above, you can get a list of every current environment string by typing SET at the command prompt. On a typical system, the output might look like this:

```
COMSPEC=C:\DOS\COMMAND.COM
PROMPT=$p$g
PATH=C:\DOS;D:\WINDOWS;D:\WINWORD
TEMP=D:\WINDOWS\TEMP
```

The COMSPEC environment variable identifies the command processor and its location—in this case, C:\DOS\COMMAND.COM. PROMPT controls the appearance of the DOS command prompt. DOS checks the environment for this variable each time a program terminates and the prompt must be redisplayed. The string \$p\$g tells DOS to display the current drive and directory (\$p) followed by a greater-than sign (\$g) as part of the prompt.

PATH lets DOS know where to search for the necessary program file if you attempt to run an external command that has its executable located somewhere other than the current directory. The TEMP environment variable informs DOS and Windows about where to store temporary files.

At startup, COMMAND.COM sets aside a block of memory called the *master environment block* to receive the environment strings that you create. Each time it loads and runs a program, COMMAND.COM copies the contents of the master environment block to a second chunk of memory called the *local environment block* and supplies the block’s

address to the program. We'll discuss the makeup of these two types of environment blocks and their relationships to each other in more detail later.

USING THE ENVIRONMENT A program may require you to create one or more environment variables for its own purposes. Microsoft's C compiler, for example, uses environment variables such as LIB and INCLUDE to determine the drive and directory holding its library and include files.

Operating systems also employ the environment. DOS and Windows look at the TEMP environment variable to find out where to store temporary files. COMMAND.COM uses the COMSPEC string to find its own image on-disk if the copy stored in memory has been overwritten by another program. And we've already seen how DOS utilizes the PROMPT and PATH environment variables.

By issuing SET commands, a batch file can create, modify, or delete environment variables; in fact, it may also reference these variables by enclosing their names in percent signs. For example, the statement

```
ECHO The PATH environment
variable is equal to %PATH%
```

displays "The PATH environment variable is equal to" followed by the value of the currently defined PATH string.

Do you ever want to add a directory name to the current PATH, but pale at the thought of having to retype the entire string just to make a simple modification? Try the one-line batch file

```
PATH=%PATH%;%1
```

Call it APATH.BAT. Now, for example, to add C:\UTIL to your PATH, type

The ASCIIZ Text Format

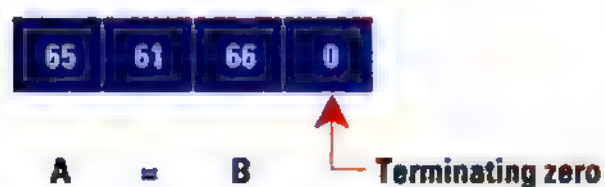


Figure 1: Strings stored in ASCIIZ format are represented by the ASCII characters that compose the string, followed by a binary zero. Here, the four bytes that make up the ASCIIZ string "A=B" are diagrammed.

APATH C:\UTIL. Sandwiching the variable name between percent signs causes DOS to substitute the variable's actual value. Note, however, that this works only in batch files, not from the command line or DOSKEY macros.

Batch files can also use environment variables to satisfy temporary storage

Although DOS can usually expand the amount of memory available to the environment, the presence of even one TSR in low memory fixes the memory size.

needs, the same way programs written in other languages use variables to store data that will be referenced later. Suppose you want a batch file containing a SHIFT command to preserve a record of its own name. Although DOS copies this information to the replaceable parameter %0, the batch file

```
SHIFT
ECHO My name is %0
```

works incorrectly because SHIFT overwrites the value of %0 with the value of %1. In contrast, the batch file

```
SET MYNAME=%0
SHIFT
ECHO My name is %MYNAME%
```

solves the problem by saving the value of %0 in an environment string with the variable name MYNAME.

SIZING THE ENVIRONMENT At startup, COMMAND.COM sets aside a fixed amount of memory that becomes the master environment block. If this space fills up and you try to create a new environment string, you receive the error message "Out of environment space" and the string is truncated. This commonly occurs when you run batch files that use environment variables for temporary storage. Although DOS can usu-

ally expand the amount of memory available to the environment, the presence of even one TSR in low memory fixes the environment's size. The TSR limits the contiguous memory that DOS can allocate immediately adjacent to the master environment block. When this happens, it's up to you to increase the environment size.

Starting COMMAND.COM with a /E switch is the easiest way to increase the environment size. The default environment size is 256 bytes for DOS 5.0, 160 for versions 3.3 and 4.0, and 128 bytes for earlier releases. In DOS 3.2 and later, the number following the /E switch specifies the environment size in bytes. Valid values are 160 to 32,768. The command

```
COMMAND /E:512
```

starts a second copy of COMMAND.COM and sets the environment to 512 bytes. In DOS 3.1, the number accompanying the /E switch may range from 11 to 62 and it specifies the environment size in 16-byte sections known as paragraphs. Prior to release 3.1, /E was not supported, so changing the environment size required a patch to COMMAND.COM.

If you run DOS 3.2 or later, you may specify the desired environment space by adding a SHELL statement to CONFIG.SYS. The line

```
SHELL=C:\DOS\COMMAND.COM
C:\DOS /E:1024 /P
```

loads COMMAND.COM from C:\DOS, sets COMSPEC equal to C:\DOS, reserves 1,024 bytes for environment strings, and tells COMMAND.COM that it's the primary command processor (/P). Be sure to include the /P switch; without it, COMMAND.COM won't process your AUTOEXEC.BAT file. Worse, DOS will crash if you type EXIT at the command prompt.

Windows users often encounter the problem of a batch file that, although it runs fine outside of Windows, produces an "Out of environment space" message when executed from within Windows. This usually happens because the primary copy of COMMAND.COM (the one loaded when the system was booted) was started with a /E switch, but the sec-

Hex Dump of an Environment Block

43 4F 4D 53 50 45 43 3D-43 3A 5C 44 4F 53 5C 43	COMSPEC=C:\DOS\C
4F 4D 4D 41 4E 44 2E 43-4F 4D 00 50 52 4F 4D 50	COMMAND.COM.PROMP
54 3D 24 70 24 67 00 50-41 54 48 3D 44 3A 5C 57	T=\$p\$g.PATH=D:\W
49 4E 44 4F 57 53 3B 43-3A 5C 44 4F 53 3B 45 3A	INDOWS;C:\DOS;E:
5C 57 49 4E 44 45 56 5C-42 49 4E 3B 45 3A 5C 43	\WINDEV\BIN;E:\C
37 30 30 5C 42 49 4E 3B-47 3A 5C 42 4F 52 4C 41	700\BIN;G:\BORLA
4E 44 43 3B 43 3A 5C 55-54 49 4C 3B 43 3A 5C 57	NDC;C:\UTIL;C:\W
50 3B 43 3A 5C 50 45 3B-43 3A 5C 4D 41 53 4D 5C	P;C:\PE;C:\MASM\
42 49 4E 00 54 45 4D 50-3D 44 3A 5C 57 49 4E 44	BIN.TEMP=D:\WIND
4F 57 53 5C 54 45 4D 50-00 00 2E 2E 2E 2E 2E 2E	OWS\TEMP.....

Figure 2: Environment variables are stored in memory as a series of ASCII strings. A 0-byte immediately following the zero that marks the end of a string signifies that there are no more environment strings.

ondary copy (started from a PIF file) was not. To remedy this, edit the PIF file and enter the same /E switch in the Optional Parameters box that appears in the SHELL statement in CONFIG.SYS. This ensures that secondary copies of COMMAND.COM running within Windows get the same amount of environment space as the primary copy, and it should eliminate the "Out of environment space" messages.

INSIDE THE ENVIRONMENT Internally, DOS stores environment variables as a series of ASCII strings. ASCII means ASCII ending in zero. Figure 1 shows how the string "A=B" would appear stored in ASCII format. The first byte holds 65, the ASCII code for a capital A. The second and third bytes contain the ASCII codes for the equal sign and the letter B. The fourth byte holds a 0, which marks the end of the string. Each string in the environment begins immediately after its predecessor, with the final one followed by an extra zero, marking the end of all the environment strings.

This is illustrated in Figure 2, which shows a hex dump of a typical environment block. You can clearly see the COMSPEC, PROMPT, PATH, and TEMP strings (in that order) separated by zeros. The TEMP environment variable ends in two zeros, indicating that no more strings remain.

Where are environment blocks located? Type MEM /P under DOS 5.0 and you'll see a line containing COMMAND in the Name column and Environment in the Type column. This entry corresponds to the master environment block. The

hexadecimal number in the Address column is the absolute address of the 16-byte memory control block that precedes the environment block. To view the master environment block, take this address, drop the zero in its rightmost place and add 1 to the three-digit number that remains. Call the result xxx. Start DEBUG and at its prompt type:

D xxx:0

If, for example, the Address column shows 58C0, start DEBUG and type D 58D:0. The first 128 bytes of the environment block will display. Entering D with no parameters displays subsequent 128-byte blocks.

When you type MEM /P you may see not one, but several memory blocks that say Environment under Type. In most cases, the others are local environment blocks allocated for individual programs. Note, for instance, two memory blocks are assigned to MEM. One holds the program itself, but the other is its local environment block. In the same manner, every running program gets its own copy of the environment, enabling any executable to reference the environment strings. This also means that one application can change its block without affecting another program that relies on environment information.

A program can deallocate the memory set aside for its local environment block, freeing the RAM for other uses. As a result, MEM /P will show that some TSRs have environment blocks, while others don't.

Local and master environment blocks differ in two important respects. First, beginning with Version 3.0, DOS copies 01h to the local environment block, just after the zero marking the end of the environment strings. Following that, it tacks on (in ASCII format) the name of and path to the program that owns the environment block. By inspecting this string, a program can determine the name of its own executable file and where it's located on the disk.

Second, local environment blocks are just long enough to hold the strings contained in the master environment block and the one specifying the name of and path to the program. Thus, unless your master environment block is full or nearly so (DOS always rounds the size of an environment block up to the nearest 16-byte boundary), local environment blocks will be somewhat smaller.

More than one master environment block may be present, sometimes. If a second copy of COMMAND.COM is loaded (when, for example, you shell out to DOS from an application or start a DOS session within Windows), the secondary copy creates a master environment block of its own that, in effect, becomes the active master environment. If

If you start a DOS session in Windows, create an environment string, then close the session and terminate Windows, the string will no longer appear.

you type a SET command, the changes are registered in the new master environment block, *not* in the original. That's why if you start a DOS session in Windows, create an environment string, then close the session and terminate Windows, the string will no longer appear. It was destroyed when the secondary copy of COMMAND.COM (and its corresponding master environment block) were wiped from memory. □

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Exploring the Program Manager Group File Format

BY NEIL J. RUBENKING

T

he Windows Program Manager seems simple enough on the surface. Double-click on a group icon and it opens up into a group window. Double-click on an item in the group window and up comes the corresponding program. There's nothing to it!

A look under the hood, however, shows that doing such "simple" things is hardly easy. ProgMan must know the names and command lines for all the program items. It must remember where the group window was the last time it was opened. And it must also be able to handle switching to open applications via hotkeys. ProgMan's group windows are complicated indeed, and the .GRP files that store all the necessary information about group windows have a very intricate, convoluted, and confusing format. Indeed, perhaps the most impressive ProgMan feature is that it can read and write .GRP files!

You may have noticed that few if any Windows INSTALL utilities create .GRP files directly; it's just too difficult. Instead, they send DDE messages to get ProgMan to create the .GRP files for them. Until the release of the Windows 3.1 SDK, the .GRP file format wasn't even documented. Now that it has been, with a bit of programming it's possible at least to read and utilize the information that is stored in .GRP files. In addition to discussing the .GRP format, therefore, I'll present two short utilities—GROUPVU.EXE and GROUPMEN.EXE—that demonstrate how to read and make use of .GRP file information.

ANATOMY OF A .GRP FILE Some file formats simply repeat the same record structure over and over. You can find the start of any record in such a file simply by mul-

tiplying the record number by the record size. Other files have a fixed-size header followed by a series of identical records; again, it's easy to find a given record. Tracing the .GRP format, on the other hand, is like wandering through a maze of twisty little passages. In many cases, the data structure fields in the file don't contain *data* about the group, but hold instead an offset that defines the *location* of that data, which is stored elsewhere in the file. Thus, the only dependable way to read a .GRP file is to start at the begin-

*Now that the Windows 3.1
SDK has documented
the .GRP format, we
can build an object
that will read them
and use the information
they contain.*

ning and keep reading until you find what you're looking for.

The GROUPHEADER structure, which begins every .GRP file, is the only really stable part of the file. Except for its last field, the header is fixed in size. That last field is an array that contains the offsets for the ITEMDATA structures, which define individual items within the group window. The next-to-last field in the header specifies how many elements this array holds. Other header fields tell where within the ProgMan window the group icon is displayed, the normal size of the group window, and the offset into the .GRP file of the group's name.

Each ITEMDATA structure contains

information about a single program item in the group. The most useful ITEMDATA fields are those that indicate the program's command line and displayed name. These strings are not, in fact, contained in the ITEMDATA structure itself. The ITEMDATA fields instead hold offsets to the location of the strings within the .GRP file.

The remaining ITEMDATA fields relate to the program's icon. One of these fields tells ProgMan where to place the icon within the group window; another field holds the offset of an ICON-RESOURCEHEADER structure that is stored in the file.

In Windows 3.1, but not 3.0, a .GRP file ends with a series of TAGDATA structures. As the name implies, these structures "tag" information about an item's properties: its hotkey, whether it should run minimized, and the directory that holds the program. This last might seem redundant, since the ITEMDATA structure holds the item's command line, but it is necessary because of the specific way ProgMan works. When a working directory for an item is defined in ProgMan's File|Properties dialog box, the command line is stored as if the item's program were present in the working directory. For example, if an item has the command line C:\FOO\SNAFU.EXE and a working directory D:\BAR, the ITEMDATA command line will be D:\BAR\SNAFU.EXE. The TAGDATA record corresponding to this item will hold the actual file location.

Since the location of data structures in the file is controlled by offsets stored in other data structures, a .GRP file could be rather chaotic. Fortunately, however, I've observed that most .GRP files have a structure similar to that shown in Figure 1. The header is always at the start of the file, and the tag data at the end. In between, the ITEMDATA structures are

Typical Layout of a .GRP File

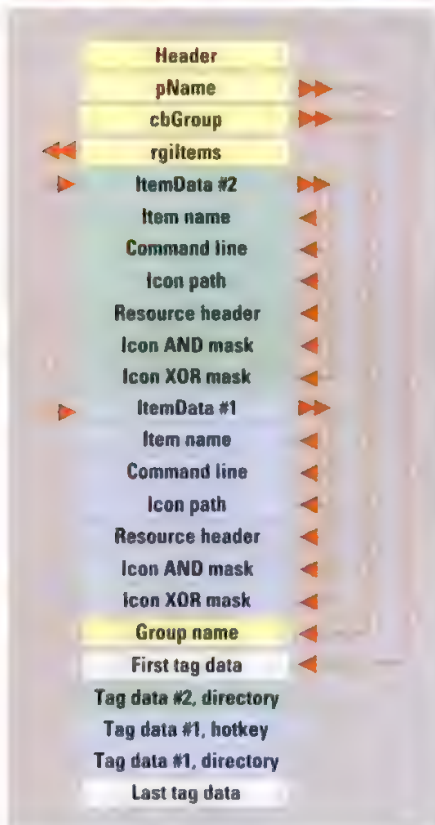


Figure 1: Although the specifics are subject to variation, this diagram illustrates a typical layout for a very small .GRP file.

generally followed immediately by the other data items related to the same program. Bear in mind, however, that no law says a .GRP file's data has to follow this order.

The file GROUPTYP.PAS imple-

ments Borland Pascal data types to match each of the .GRP file structures and includes equivalent C data structures as comments. This file and all of the files associated with this article can be compiled with Borland Pascal 7.0 or Turbo Pascal for Windows 1.5. You can download all files associated with this article from PC MagNet by following the procedure outlined in the "Downloading Utilities" sidebar in this issue's Utilities column. Look for the archive GROUP.ZIP. Let's look at the details of those data structures.

THE GROUP FILE DATA TYPES Every .GRP file starts with a header, defined by the TGroupHeader data type shown in Figure 2. The first 4 bytes must always contain the characters PMCC; if they don't, the .GRP file is invalid. The next data field, wChecksum, is also dedicated to validating the file. In a proper .GRP file, the sum of all the Words of data in the file (ignoring overflow) must be 0. The value of the wChecksum field in the header is selected to make this so. Looking at it in another way, wChecksum is the negative of the sum of all the other Words in the file.

In Windows 3.0, the cbGroup field was defined as the size of the .GRP file, in bytes. With the advent of version 3.1, this is no longer accurate. The cbGroup field is now the size of the file excluding the TTagData items. Thus in a Windows 3.1 .GRP file, the field can be treated as the offset of the first TTagData item.

The next four fields tell ProgMan how to display the group. The nCmdShow

field determines whether the group window is initially minimized, maximized, or normal; rcNormal is a rectangle structure that defines the normal size of the window; and the point ptMin is the location of the lower left corner of the icon when the group window is minimized. The name of the group window is a string located at the offset specified by the pName field.

Next come several fields related to displaying the icons within the group. Note that the SDK reference lists the bBitsPerPixel and bPlanes fields as Word values, but that it also omits the wReserved Word that follows them. These two errors cancel out; otherwise the offset of the remaining fields would be wrong. Since dealing with .GRP file icons is a complex enough subject for a Lab Notes of its own, this article will not consider the icon-related fields.

The cItems field holds the number of elements in the rgItems array, which immediately follows it. Since a group can have at most 50 items, rgItems is defined as an array of 50 Words, and cItems specifies the actual number of elements in it. Each element of rgItems is the offset of a TItemData structure within the file, or a 0, if the element is unused. Since some elements may be unused, cItems is not necessarily the number of program items in the group.

Each of the TItemData structures pointed to by the rgItems array in the TGroupHeader (see Figure 3) contains information about a particular program item. The majority of the TItemData

GROUPTYP.PAS

Partial Listing

```

UNIT GroupType;
(**) INTERFACE (**
USES WinTypes;
(*NOTE: In the data structures that follow, I've marked important
fields with the symbol (!). *)
TYPE
  rgItemsType = ARRAY[0..49] OF Word; (max 50 items per group)

  TGroupHeader = TGroupHeader;
  TGroupHeader = RECORD
    (!) cIdentifier : ARRAY[0..3] OF Char; (must be 'PMCC')
    (!) wChecksum : Word; (adjusted to make the sum of all the
      words in the group file be 0)
    (!) cbGroup : Word; (size of the group file, in bytes, NOT
      including the tag data.)
    (!) nCmdShow : Word; (flag that tells how ProgMan displays
      the group; see SW_XXXX constants for
      the ShowWindow API function)
    (!) rcNormal : TRect; (the coordinates used by the group
      window when neither min nor max)
    (!) ptMin : TPoint; (the coordinates for the lower-left
      corner of the group window in ProgMan)
    (!) pName : Word; (offset from the beginning of the file
      to the group's name string)
    wLogPixelsX : Word; (horizontal resolution of device for
      which the group icons were created)
    wLogPixelsY : Word; (vertical resolution of device for
      which the group icons were created)
    (*NOTE: Next two items erroneously listed as WORD in SDK)

    wBitsPerPixel : Byte; (bits per pixel of icon bitmaps)
    wPlanes : Byte; (count of bitplanes in icon bitmaps)
    (*NOTE: Next items omitted from structure in SDK)
    wReserved : Word; (reserved - should be 0)
    (!) cItems : Word; (number of TItemData structures in the
      rgItems array)
    (!) rgItems : rgItemsType; (an array of offsets to TItemData
      structures in the group file. NOTE:
      SDK says this is an array of ItemData
      structures - it is incorrect)
  END;

(* Equivalent structure in C
struct tagGROUPHEADER {
  char cIdentifier[4];
  WORD wChecksum;
  WORD cbGroup;
  WORD nCmdShow;
  RECT rcNormal;
  POINT ptMin;
  WORD pName;
  WORD wLogPixelsX;
  WORD wLogPixelsY;
  BYTE bBitsPerPixel;
  BYTE bPlanes;
  WORD wReserved; // Should be 0x0000
  WORD cItems;
  WORD rgItems[cItems];
}*)

```

Figure 2: Every .GRP file begins with a GROUPHEADER structure that contains information about the group itself.

GROUPTYP.PAS

Partial Listing

```

TYPE
  PItemData = ^TItemData;
  TItemData = RECORD
  (!) pt      : TPoint; (the coordinates for the lower-left
                        corner of an icon in the group window.)
  iIcon      : Word; (the index value for the icon, i.e. the
                        position of the icon in its file
                        (see pIconPath))
  cbHeader   : Word; (the count of bytes in the icon resource
                        (cbResource))
  cbANDPlane : Word; (the count of bytes in the icon's AND mask)
  cbXORPlane : Word; (the count of bytes in the icon's XOR mask)
  pHeader    : Word; (offset from the beginning of the group
                        file to the icon's resource header (see
                        TIconResourceHeader))
  pANDPlane  : Word; (offset from the beginning of the group
                        file to the icon's AND mask)
  pXORPlane  : Word; (offset from the beginning of the group
                        file to the icon's XOR mask)
  (!) pName  : Word; (offset from the beginning of the group
                        file to the item name string)

  (!) pCommand : Word; (offset from the beginning of the group
                        file to the command line string)
  pIconPath   : Word; (offset from the beginning of the group
                        file to the name of the file containing
                        the icon for this item)
  END;

(* Equivalent structure in C:
  struct tagITEMDATA {
  POINT pt;
  WORD iIcon;
  WORD cbHeader;
  WORD cbANDPlane;
  WORD cbXORPlane;
  WORD pHeader;
  WORD pANDPlane;
  WORD pXORPlane;
  WORD pName;
  WORD pCommand;
  WORD pIconPath;
  }*)

```



Figure 3: Each ITEMData structure in the .GRP file holds information about one program item within the group.

fields relate to the item's icon. The pHeader field is the offset of the item's ICONRESOURCEHEADER structure, which is shown in Figure 4.

The three fields of interest in Figure 3 are pt, pName, and pCommand. (Note that these are marked in the figure with a (!) for emphasis.) The first is a point structure that contains the coordinates of the lower left corner of the icon within the group window. The pName field contains the offset within the .GRP file of the name displayed for this item, and pCommand is the offset of the item's command line.

TTagData structures, shown in Figure 5, are present only in Windows 3.1 .GRP files. These structures hold data controlled by the File|Properties dialog in ProgMan. Specifically, they contain the Working Directory, Shortcut key, and Run minimized lines from that dialog box. The first TTagData item in the file lies at the offset specified by the cbGroup field of the header. If this offset is the end of the file, there are no tag data items. A TTagData structure's wItem field identifies the corresponding item, and the cb field is the structure's size in bytes. The size and data type of the last field varies, depending on the value of the wID field.

The wID field is 8000h in the very first TTagData structure and FFFFh in the last. You can thus skip over the first structure by reading the number of bytes indicated in its cb field. Don't rely on the cb field in the last TTagData structure, however, as it seems to always be 0. Observation reveals that the wItem field of the first and last TTagData structures is FFFFh and that the data portion of the first is the string PMCC.

Between the first and last TTagData structure are the structures that actually carry the data. A wID field value of 8103h means that the corresponding item is to be run minimized. There being no need for any additional data in this case, the last field is empty and the cb field has the value 6. A wID value of 8102h means that the last field is a Word that defines the shortcut key for the corresponding item. The low byte of the Word is the ASCII code of the key itself, and the high byte is the sum of values that represent the shift keys (2=Ctrl, 1=Shift, 4=Alt).

If the wID field's value is 8101h, the last field is a null-delimited string containing the actual path to the program involved. The string's length can be calculated on the basis of the size contained in the cb field. Remember, however, that the pCommand string in the ITEM-

DATA structure is not necessarily the same string shown as the command line in the File|Properties dialog. If a working directory was specified, the pCommand string replaces the path of the item's program with the working directory. That's why it is necessary to store the actual path in a TTagData structure.

AN OBJECT FOR .GRP FILE ACCESS The data structures of the elements of a .GRP file have now been completely defined. However, reading a .GRP file is not just a matter of loading one or another data structure from disk. Rather, it's a complicated process that requires a number of routines that work with the data contained in the data structures. Data combined with routines to work on the data is one simple definition of an *object*. The listing for the object TGroupFile, which handles the task of reading .GRP files,

GROUPTYP.PAS

Partial Listing

```

TYPE
  PIconResourceHeader = ^TIconResourceHeader;
  TIconResourceHeader = RECORD
  xHotSpot : Integer; (Should be 0)
  yHotSpot : Integer; (Should be 0)
  cx       : Integer; (Icon width)
  cy       : Integer; (Icon height)
  cbWidth  : Integer; (Bytes per row accounting for WORD alignment)
  bPlanes  : Byte; (Count of planes)
  bBitsPixel : Byte; (Bits per pixel)
  END;

(* Equivalent structure in C:
  struct tagICONRESOURCEHEADER {
  int xHotSpot; // Should be 0
  int yHotSpot; // Should be 0
  int cx; // Icon width
  int cy; // Icon height
  int cbWidth; // Bytes per row accounting
               // for WORD alignment
  BYTE bPlanes; // Count of planes
  BYTE bBitsPixel; // Bits per pixel
  }*)

```



Figure 4: The ICONRESOURCEHEADER structure is included in this partial listing for completeness in covering the .GRP file format.

GROUP.TYP.PAS

Partial Listing

```

TYPE
  TTagData = ^TTagData;
  TTagData = RECORD
    wID : Word; {identifies type of tag data. Possible values:
      Value Meaning
      0000h the first TTagData structure
      0101h rgbString is the item's path as an ASCII string.
      NOTE: Changing "Working Directory" in the Properties
            dialog changes the *command* for the item; the
            TTagData shows the actual location of the app.
      0102h rgbShortcut identifies the hotkey for the item.
            Its high byte is a combination of any two of:
              2 = Ctrl
              1 = Shift
              4 = Alt
            Its low byte is the ASCII code of the key.
      0103h If present, means the item will run minimized.
            The structure is just 6 bytes in size.
      FFFFh the last TagData structure; don't rely on cb
    }
  end;

```

```

    to reflect size, as it is usually 0
  wItem : Word; {number of item corresponding to this tag}
  cb : Word; {size in bytes of the TTagData structure}
CASE Word OF
  $0101 : (rgbString : ARRAY[0..144] OF Char);
  $0102 : (rgbShortcut : Word);
  $0103 : (rgbNada : RECORD END);
END;

(* Equivalent structure in C
  struct tagTAGDATA{
    WORD wID;
    WORD wItem;
    WORD cb;
    BYTE rgb[1];
  };
  **) IMPLEMENTATION (**
END.

```



Figure 5: TAGDATA structures, which exist only in Windows 3.1 .GRP files, store extra information about program properties.

is contained in the file GROUPFIL.PAS, which is shown in Figure 6.

TGroupFile's Init Constructor opens and verifies the .GRP file, then stores the TTagData information for easy access. It starts by allocating space for and then reading in all but the last field of the TGroupHeader record. It checks that the characters PMCC are the first 4 bytes and validates the checksum. As indicated above, in a valid .GRP file the sum of all the Word values in the file (ignoring overflow) is 0; the method CalcCkSum calculates this sum. If an error occurs, the Constructor sets the data field Status to an appropriate value. The calling program can use the GetStatStr method to retrieve an error string that corresponds to the error. Such error strings are stored in the resource defined by the script GROUPFIL.RC, shown in Figure 7.

Assuming an existing, valid .GRP file, the Constructor reallocates enough memory to hold the rgItems field of TGroupHeader. It then rereads the header. Other methods will subsequently use the offset information in the rgItems field to locate individual TItemData structures.

The next step is to read the tag data. Since this data has no inherent order, TGroupFile imposes one by defining three arrays of 50 items, one for each type of tag data. The Init Constructor simply reads each TTagData structure from the file and stores its information in one of the three arrays. Thus, the *n*th element of the TagHot array contains the hotkey Word for the *n*th program item, or a 0 if no hotkey exists. The TagDir array's elements (also Words) are offsets for the item's path in the .GRP file. Finally, Tag-

Min is an array of Boolean values; it is TRUE only if the corresponding item is to be run minimized.

TGroupFile's destructor deallocates the memory used to hold the file header and closes the .GRP file. Note that the file remains *open* from the time the Constructor is called to the time the Destructor is called. This is necessary to provide quick access to data items stored as offsets into the file. However, it does suggest that your programs should use only one or two TGroupFile objects at a time.

A number of TGroupFile's methods (fwChecksum through fclItems in Figure 6) simply return the value of a field in the .GRP file header. The PCharFmOffset method takes an offset into the file and gets the string stored at that offset. This method requires the calling program to supply a buffer; it simply reads the spe-

GROUPFIL.PAS

1 of 2

```

{$R-}
UNIT GroupFile;
(**) INTERFACE (**
{$IFDEF VER70}
{$O-}
USES Objects,
{$ELSE}
USES WObjects,
{$ENDIF}
WinTypes, WinProcs, Strings, GroupType;
{$R GROUPFIL.RES}
{$I GROUPFIL.INC}

TYPE
  PGroupFile = ^TGroupFile;
  TGroupFile = OBJECT(TObject)
    {This object only implements methods to get group file info that
     I consider IMPORTANT. You can always create a descendant and
     add methods to, for example, get the wBitsPerPixel field, or
     *write* data back to the GRP file.}
    F : File; {Note that F is opened in the
      Constructor and not closed 'til the
      Destructor}
    PGR : PGroupHeader;
    HdrSize, Status : Word;
    TagDir, TagHot : rgItemTypes;
    TagMin : ARRAY[0..49] OF Boolean;
    CONSTRUCTOR Init(PName : PChar);
    DESTRUCTOR Done; Virtual;
    FUNCTION CalcCkSum : Word;
    FUNCTION GetStatus : Word;
    FUNCTION GetStatStr(P : PChar; MaxLen : Word) : PChar;
    PROCEDURE ClearStatus;
    FUNCTION cIdok : Boolean;
    FUNCTION fwChecksum : Word;
    FUNCTION fcbGroup : Word;
  end;

```

```

  FUNCTION fncdShow : Word;
  FUNCTION frcNormal : PRect;
  FUNCTION fptMin : PPoint;
  FUNCTION fcItems : Word;
  FUNCTION PCharFmOffset(Offset : Word; P : PChar; MaxLen :
    Word) : PChar;
  FUNCTION fpName(P : PChar; MaxLen : Word) : PChar;
  FUNCTION GetNthItem(N : Word; VAR TID : TItemData) : Boolean;
  FUNCTION GetItemTagMin(Item : Word) : Boolean;
  FUNCTION GetItemTagDir(Item : Word; P : PChar; MaxLen : Word) :
    Boolean;
  FUNCTION GetItemTagHot(Item : Word; VAR HotKey : Word) : Boolean;
  FUNCTION GetItemTagHotStr(Item : Word; P : PChar; MaxLen :
    Word) : Boolean;
END;

(**) IMPLEMENTATION (**

CONSTRUCTOR TGroupFile.Init(PName : PChar);
VAR
  dirPos, W : Word;
  V6a+20V : Integer;
  TID : TItemData;
  TTD : TTagData;
BEGIN
  Status := msg_Ok;
  {First read and verify fixed-size portion of header}
  HdrSize := SizeOf(TGroupHeader) - SizeOf(rgItemTypes);
  GetMem(PGR, HdrSize);
  FillChar(PGR, HdrSize, 0);
  Assign(F, PName);
  {$I-} Reset(F, 1); {$I+}
  I := IOResult;
  IF I <> 0 THEN
    BEGIN
      Status := msg_OpenFileFailed;
      FillChar(PGR, HdrSize, 0);
    END;
  END;

```



Figure 6: Reading the complex .GRP file structure requires a variety of functions, all of which are encapsulated in the TGroupFile object.

GROUPFIL.PAS

2 of 2

```

END;
BlockRead(F, PGM, HdrSize);
IF NOT cIdOK THEN
BEGIN
    Status := msg_NotGRPFFile;
    FillChar(PGM, HdrSize, 0);
    Exit;
END;
IF CalcCkSum <> 0 THEN
BEGIN
    Status := msg_CheckSumBad;
    Exit;
END;
W := PGM^.cItems;
FreeMem(PGM, HdrSize);
(Now calculate actual header size and re-read COMPLETE header)
HdrSize := SizeOf(TGroupHeader) - SizeOf(rgiItems) + 2*W;
GetMem(PGM, HdrSize);
Seek(F, 0);
BlockRead(F, PGM, HdrSize);
(Fill arrays with tag info for hotkey and dir tags)
FillChar(TagHot, SizeOf(TagHot), 0);
FillChar(TagDir, SizeOf(TagDir), 0);
FillChar(TagMin, SizeOf(TagMin), FALSE);
IF fcbGroup = FileSize(F) THEN Exit;
Seek(F, fcbGroup);
BlockRead(F, TTD, 6);
(First tag should have wID=$8000)
IF TTD.wID <> $8000 THEN
BEGIN
    Status := msg_FirstTagBad;
    Exit;
END;
BlockRead(F, TTD.rgbString, TTD.cb-6);
REPEAT
    (read fixed-size portion of tag, including actual size in cb)
    BlockRead(F, TTD, 6);
    IF TTD.wID <> $FFFF THEN
    BEGIN
        (read remainder of tag data)
        DirPos := FilePos(F);
        BlockRead(F, TTD.rgbString, TTD.cb-6);
        CASE TTD.wID OF
            $8101 : TagDir[TTD.witem] := DirPos;
            $8102 : TagHot[TTD.witem] := TTD.rgbShortcut;
            $8103 : TagMin[TTD.witem] := TRUE;
            ELSE
                Status := msg_TagBad;
                Exit;
            END;
        END;
    UNTIL TTD.wID = $FFFF;
END;
DESTRUCTOR TGroupFile.Done;
BEGIN
    FreeMem(PGM, HdrSize);
    ($I-) Close(F); ($I+)
    IF IOResult <> 0 THEN (tough!);
    TObject.Done;
END;
FUNCTION TGroupFile.GetStatus : Word;
BEGIN
    GetStatus := Status;
END;
FUNCTION TGroupFile.GetStatStr(P : PChar; MaxLen : Word) : PChar;
BEGIN
    LoadString(hInstance, Status, P, MaxLen);
    GetStatStr := P;
END;
PROCEDURE TGroupFile.ClearStatus;
BEGIN
    Status := msg_OK;
END;
FUNCTION TGroupFile.CalcCkSum : Word;
(If value of wChecksum field of header is correct, this
function returns 0)
TYPE BuffType = ARRAY[0..32768] OF Word;
VAR
    FB : BuffType;
    CSum, N, FS : Word;
BEGIN
    FS := FileSize(F);
    GetMem(FB, FS);
    Seek(F, 0);
    BlockRead(F, FB, FS);
    CSum := 0;
    FOR N := 0 TO pred(FS DIV 2) DO Inc(CSum, FB[N]);
    CalcCkSum := CSum;
    FreeMem(FB, FS);
END;
FUNCTION TGroupFile.cIdOK : Boolean;
BEGIN
    cIdOK := StrLCmp(PGM^.cIdentifier, 'FWCC', 4) = 0;
END;
FUNCTION TGroupFile.fcChecksum : Word;
BEGIN
    fcChecksum := PGM^.wChecksum;
END;
FUNCTION TGroupFile.fcbGroup : Word;
BEGIN
    fcbGroup := PGM^.cbGroup;
END;
FUNCTION TGroupFile.fnCmdShow : Word;
BEGIN
    fnCmdShow := PGM^.nCmdShow;

```

```

END;
FUNCTION TGroupFile.frcNormal : PRect;
BEGIN
    frcNormal := @PGM^.rcNormal;
END;
FUNCTION TGroupFile.fptMin : PPoint;
BEGIN
    fptMin := @PGM^.ptMin;
END;
FUNCTION TGroupFile.fcItems : Word;
BEGIN
    fcItems := PGM^.cItems;
END;
FUNCTION TGroupFile.PCharPwOffset(Offset : Word; P : PChar;
    MaxLen : Word) : PChar;
(Reads MaxLen bytes from the file F at the specified offset
into the PChar P; returns P)
VAR Actual : Word;
BEGIN
    ($I-)
    Seek(F, Offset);
    BlockRead(F, P, MaxLen, Actual);
    ($I+)
    IF IOResult <> 0 THEN
    BEGIN
        P[0] := $0;
        Status := msg_ReadStrFailed;
        PCharPwOffset := P
    END;
END;
FUNCTION TGroupFile.fPName(P : PChar; MaxLen : Word) : PChar;
BEGIN
    fPName := PCharPwOffset(PGM^.pName, P, MaxLen);
END;
FUNCTION TGroupFile.GetNthItem(N : Word; VAR TID : TitemData) :
    Boolean;
(Valid for N from 0 to PGM^.cItems-1. If Nth item exists,
reads it into TID and returns TRUE; else FALSE.)
BEGIN
    IF PGM^.rgiItems[N] <> 0 THEN
    BEGIN
        GetNthItem := TRUE;
        ($I-)
        Seek(F, PGM^.rgiItems[N]);
        BlockRead(F, TID, SizeOf(TID));
        ($I+)
        IF IOResult <> 0 THEN
            BEGIN
                GetNthItem := FALSE;
                Status := msg_BadItem;
                END;
            END
        ELSE GetNthItem := FALSE;
    END;
FUNCTION TGroupFile.GetItemTagMin(Item : Word) : Boolean;
BEGIN
    GetItemTagMin := TagMin[Item];
END;
FUNCTION TGroupFile.GetItemTagDir(Item : Word; P : PChar;
    MaxLen : Word) : Boolean;
(If a directory tag for the item exists, returns TRUE and puts
the directory into PChar P; else returns FALSE)
BEGIN
    IF TagDir[Item] <> 0 THEN
    BEGIN
        GetItemTagDir := TRUE;
        PCharPwOffset(TagDir[Item], P, MaxLen);
        END
    ELSE GetItemTagDir := FALSE;
END;
FUNCTION TGroupFile.GetItemTagHot(Item : Word; VAR HotKey : Word) :
    Boolean;
(If a hotkey for the item exists, returns TRUE and puts hotkey
value in the HotKey argument; else returns FALSE)
BEGIN
    IF TagHot[Item] <> 0 THEN
    BEGIN
        GetItemTagHot := TRUE;
        HotKey := TagHot[Item];
        END
    ELSE GetItemTagHot := FALSE;
END;
FUNCTION TGroupFile.GetItemTagHotStr(Item : Word; P : PChar;
    MaxLen : Word) : Boolean;
(If a hotkey for the item exists, returns TRUE and puts a string
describing the hotkey into PChar P; else returns FALSE)
VAR
    HK : Word;
    chBuff : ARRAY[0..1] OF Char;
BEGIN
    IF GetItemTagHot(Item, HK) THEN
    BEGIN
        GetItemTagHotStr := TRUE;
        P[0] := $0;
        IF HI(HK) AND 2 = 2 THEN StrLCat(P, 'Ctrl+', MaxLen);
        IF HI(HK) AND 1 = 1 THEN StrLCat(P, 'Shift+', MaxLen);
        IF HI(HK) AND 4 = 4 THEN StrLCat(P, 'Alt+', MaxLen);
        chBuff[0] := Char(Lo(HK));
        chBuff[1] := $0;
        StrLCat(P, chBuff, MaxLen);
        END
    ELSE GetItemTagHotStr := FALSE;
END;
END.

```

GROUPFIL.RC

Complete Listing



```
#include "groupfil.inc"

STRINGTABLE
BEGIN
    msg_Ok, "TGroupFile OK"
    msg_OpenFileFailed, "TGroupFile ERROR: Failed to open GRP file"
    msg_NotGRPFile, "TGroupFile ERROR: Not a valid GRP file"
    msg_CheckSumBad, "TGroupFile ERROR: Check sum failed"
    msg_FirstTagBad, "TGroupFile ERROR: First TAG data structure invalid"
    msg_TagBad, "TGroupFile ERROR: TAG data structure invalid"
    msg_BadItem, "TGroupFile ERROR: Invalid item data structure"
    msg_ReadStrFailed, "TGroupFile ERROR: Failed reading string data"
END
```

Figure 7: This resource script defines a string table that contains the error messages for TGroupFile.

cified maximum number of bytes from the file into that buffer. Method fpName, which returns the group name, calls on PCharFmOffset, passing it the pName field of the header as an offset.

The GetNthItem function provides access to the TItemData structures in the .GRP file. This function returns FALSE if the *n*th element of the header's rgiItems field is 0. Otherwise, it fills a TItemData structure supplied by the calling program with data from the file and returns TRUE. The calling program can get the name and command line for the item by passing the offsets in the TItemData structure to PCharFmOffset.

Four methods are used to return tag data for items. GetItemTagMin is the simplest: It just returns the item's element in the TagMin array. GetItemTag-

Dir returns FALSE if no directory tag exists for the specified item; otherwise, it uses PCharFmOffset to retrieve the directory string and then returns TRUE.

The remaining two methods are used for returning an item's hotkey. GetItemTagHot returns FALSE if the item has no hotkey. If a hotkey exists, it copies it into the VAR parameter HotKey and returns TRUE. GetItemTagHotStr takes the process one step further; if a hotkey exists, it returns TRUE and fills the supplied PChar buffer with a string—for example, Ctrl+Alt+P—that describes the hotkey.

PROOF OF THE PUDDING: GROUPVU
GROUPFIL.PAS compiles successfully, but does the TGroupFile object it creates work? A simple test program will provide a check. In Borland Pascal, *simple* is syn-

onymous with *WinCrt*, a unit that supplies a program with a teletype window to produce line-by-line output. The tiny, WinCrt-based GROUPVU.PAS program listed in Figure 8 will serve to test the TGroupFile object.

By default, the WinCrt window emulates a simple text-mode monitor. It's 80 columns wide and 25 lines high, and any text that scrolls off is lost. The GROUPVU.EXE utility needs longer lines, however, since it puts the location,

*The first handful of
lines in GROUPVU are
designed to produce the
biggest WinCrt window
possible by setting
variables defined within
the WinCrt unit itself.*

name, command line, and hotkey of an item all on one line. It also needs many more lines if it is to read .GRP files. The first handful of lines in GROUPVU are designed to produce the biggest WinCrt window possible by setting variables defined within the WinCrt unit itself. Note

GROUPVU.PAS

Complete Listing

```
PROGRAM GroupVu;
USES WinCrt, WinTypes, WinProcs, Windows, Strings, GroupType,
    GroupFile;
CONST GroupX : PChar = 'GROUPFX';
VAR
    GroupNum : Word;
    buff : ARRAY[0..80] OF Char;
    T : TGroupFile;
    Item : Word;
    TID : TItemData;
BEGIN
    (set up *BIG* CrtWindow)
    WindowOrg.X := 0;
    WindowOrg.Y := 0;
    WindowSize.X := GetSystemMetrics(sm_CXScreen);
    WindowSize.Y := GetSystemMetrics(sm_CYScreen);
    ScreenSize.X := (WindowSize.X -
        GetSystemMetrics(sm_CXVScroll) -
        GetSystemMetrics(sm_CXFrame)) DIV 8;
    ScreenSize.Y := 65520 DIV ScreenSize.X;
    AutoTracking := FALSE;
    InitWinCrt;
    WriteLn('REPORT of all GRP files used by currently ',
        'active ProgMan groups');
    WriteLn('-----');
    FOR GroupNum := 1 TO 40 DO
    BEGIN
        wvprintf(GroupX, 'Group%u', GroupNum);
        GetPrivateProfileString('Groups', GroupX, '', buff, 80,
            'PROGRAM.INI');
        IF buff[0] <> #0 THEN
        BEGIN
            Write(GroupX, ' = ', buff);
            T.Init(buff);
            IF T.GetStatus <> msg_Ok THEN
            BEGIN
                WriteLn(' - ', T.GetStatStr(buff, 80));
            END;
        END;
    END;
END;
```

```
WriteLn;
END
ELSE
BEGIN
    WriteLn(' ', T.fpName(buff, 80), ' ');
    Write(' Display status : ');
    CASE T.InCmdShow OF
        0 : WriteLn('Hide ');
        1,4,5,8,9 : WriteLn('Normal ');
        2,6,7 : WriteLn('Minimized ');
        3 : WriteLn('Maximized ');
    END;
    WITH T.frcNormal DO
        WriteLn(' normal coords : (', left, ', ', top,
            ', ', right, ', ', bottom, ')');
    WITH T.frcMin DO
        WriteLn(' minimized pos: (', left, ', ', top, ')');
    FOR Item := 0 TO pred(T.frcItems) DO
        IF T.GetNthItem(Item, TID) THEN
        BEGIN
            WITH TID.Pt DO Write(' ', X:3, ', ', Y:3, ' ');
            IF T.GetItemTagMin(Item) THEN Write(' < ');
            Write(' ', T.PCharFmOffset(TID.pName, buff,
                80));
            Write(' - ', T.PCharFmOffset(TID.pCommand,
                buff, 80));
            IF T.GetItemTagHotStr(Item, buff, 80) THEN
                WriteLn(' << ', buff, '>>')
            ELSE WriteLn;
        END;
    END;
    WriteLn;
    T.Done;
END;
END;
```



Figure 8: GROUPVU uses the object defined in the GROUPFIL unit to read all active ProgMan .GRP files and display a report in a scrolling window.

Report of .GRP Files

Partial Listing

REPORT of all GRP files used by currently active ProgMan groups

```

Group4 - E:\WINDOWS\MAIN.GRP "Main"
  Display status : Minimized
  normal coords : (90,90,402,286)
  minimized pos'n: (281,29)
  ( 21, 0) "MS-DOS Prompt" - DOSPRMPT.PIF
  ( 96, 0) "Control Panel" - CONTROL.EXE
  (171, 72) "Windows Setup" - SETUP.EXE
  (171, 0) "File Manager" - WINFILE.EXE
  ( 21, 72) "Print Manager" - PRINTMAN.EXE
  ( 96, 72) "PIF Editor" - PIFEDIT.EXE
  (246, 0) "Clipboard Viewer" - CLIPBRD.EXE

Group8 - E:\WINDOWS\STARTUP0.GRP "Startup"
  Display status : Minimized
  normal coords : (0,0,240,245)
  minimized pos'n: (465,23)
  (171, 72) "Windows Restart" - D:\WINDOWS\RESTART.EXE
  ( 96, 72) <m> "OutaGas" - E:\WINDOWS\BOOK\OUTAGAS.EXE
  ( 21, 72) "BurnUp" - E:\WINDOWS\BOOK\BURNUP.EXE
  (171, 0) <m> "Wallpaper" - E:\WINDOWS\BOOK\WALLPAPR.EXE
  ( 96, 0) "Program Manager" - PROGMAN.EXE <<Ctrl+Shift+Alt+X>>
  ( 21, 0) "GroupMenu" - E:\UTIL\PM\GROUPMEN.EXE

```

Figure 9: The GROUPVU.EXE utility reports on the contents of all .GRP files, as shown in this abbreviated example of its output.

this technique—you may find it handy in other programs.

Variables WindowOrg and WindowSize control the location and size of the WinCrt window, and ScreenSize holds the number of rows and columns. It's not enough simply to set WindowOrg and

WindowSize to fill the screen, because WinCrt will shrink the window to fit the rows and columns defined by ScreenSize. In GROUPVU, ScreenSize.X (the number of columns) is set to the maximum client area width divided by 8 (the pixel width of SYSTEM_FIXED_FONT).

The product of the X and Y fields of ScreenSize must not exceed 65,520, so the program simply divides 65,520 by the X value and assigns the result to Y. Finally, it sets the variable AutoTracking to FALSE. When AutoTracking is TRUE, the WinCrt window scrolls to keep the cursor in view, which can really slow things down.

With the output window stretched to its largest possible extent, GROUPVU is ready to read .GRP files and report on their contents. The names of the .GRP files are stored in the [Groups] section of PROGMAN.INI as entries in the following form

```
Group3=C:\WINDOWS\MAIN0..GRP
```

Windows 3.1 allows a maximum of 40 groups, so GROUPVU checks keys from Group1 through Group40. (Windows 3.0 theoretically permits more than 40 groups, but I assume no one actually uses more than 40.)

When it locates a .GRP filename, GROUPVU initializes a TGroupFile object for reading that group. It prints the .GRP filename and display name for the group, followed by the display status (maximized, minimized, or normal), the normal coordinate rectangle, as well as

GROUPMEN.PAS

Partial Listing

```

CONSTRUCTOR TGroupMWindow.Init(AParent : PWindowsObject;
  AName : PChar);
CONST
  Groupx : PChar = 'GROUP99';
VAR
  N, Item : Word;
  T : TGroupFile;
  TID : TItemData;
  SubH : HMenu;
  Buff : ARRAY[0..80] OF Char;
  HotBuff,
  CmdBuff,
  ItemBuff : ARRAY[0..144] OF Char;

FUNCTION InsertMenuAlpha(Menu: HMenu; Flags, IDNewItem: Word;
  NewItem: PChar): Bool;
  (Insert the item into menu in alpha order)
VAR
  Posn, NumItems : Integer;
  found : Boolean;
  mbuff : ARRAY[0..80] OF Char;
BEGIN
  Posn := 0;
  NumItems := GetMenuItemCount(Menu);
  found := FALSE;
  IF NumItems > 0 THEN
    WHILE (Posn < NumItems) AND (NOT found) DO
      BEGIN
        GetMenuItemText(Menu, Posn, mbuff, 80, MF_BYPOSITION);
        IF StrICmp(NewItem, mbuff) < 0 THEN found := TRUE
        ELSE Inc(Posn);
      END;
    END;
  InsertMenuAlpha := InsertMenu(Menu, Posn, Flags, IDNewItem,
    NewItem);
END;

BEGIN
  TWindow.Init(AParent, AName);
  New(Commands, Init(0, 8));
  Attr.Menu := LoadMenu(hInstance, AppName);
  FOR N := 1 TO 40 DO (max of 40 groups)
    BEGIN
      wvprintf(Groupx, 'Group%u', N);
      GetPrivateProfileString('Groups', Groupx, '', Buff, 80,
        'PROGMAN.INI');

```

```

  IF Buff[0] <> #0 THEN
    BEGIN
      (Buff holds FILENAME of Nth group)
      T.Init(Buff);
      IF T.GetStatus <> msq_Ok THEN
        MessageBox(hWindow, T.GetStatStr(itemBuff, 144),
          Buff, mb_Ok + mb_IconInformation);
      ELSE
        BEGIN
          T.FpName(buff, 80); (buff now holds name of group)
          SubH := CreateMenu;
          FOR Item := 0 TO T.fcItems-1 DO
            IF T.GetNthItem(Item, TID) THEN
              BEGIN
                T.PCharFmOffset(TID.pName, itembuff, 80);
                IF T.GetItemTagHotStr(Item, Hotbuff, 80) THEN
                  BEGIN
                    StrLCat(itemBuff, '(', 144);
                    StrLCat(itemBuff, HotBuff, 144);
                    StrLCat(itemBuff, ')', 144);
                  END;
                IF NOT T.GetItemTagDir(Item, cmdBuff+1, 144) THEN
                  StrCopy(cmdBuff, ' ');
                IF T.GetItemTagMin(Item) THEN cmdBuff[0] := 'm'
                ELSE cmdBuff[0] := 'M';
                StrLCat(cmdBuff, ' ', 144);
                T.PCharFmOffset(TID.pCommand, StrEnd(Cmdbuff),
                  144-StrLen(CmdBuff));
                (add program name to submenu, in order)
                InsertMenuAlpha(SubH, MF_STRING +
                  MF_BYPOSITION, Commands.Count+cm_Progs,
                  itemBuff);
                (add command info to collection)
                Commands.Insert(StrNew(CmdBuff));
              END;
            (add submenu to main menu, in order)
            InsertMenuAlpha(Attr.Menu, MF_POPUP + MF_BYPOSITION,
              SubH, buff);
          T.Done;
        END;
      END;
    END;
  END;
END;

```



Figure 10: The Init Constructor for a TGroupMWindow reads all of the ProgMan .GRP files and builds its menu based on their contents.

GROUPMEN.PAS

Partial Listing

```

PROCEDURE TGroupMWindow.JustMenu(Wid : Word);
VAR
  OrgH, Hig,
  Hig1, MaxH : Word;
  R          : TRect;
BEGIN
  (Size window so nothing but complete menu is shown)
  Hig1 := GetSystemMetrics(sm_CYMenu)+1;
  OrgH := GetSystemMetrics(sm_CYCaption) +
    2*GetSystemMetrics(sm_CYFrame)-1;
  Hig := OrgH;
  MaxH := GetSystemMetrics(sm_CYScreen);
  REPEAT
    Inc(Hig, Hig1);
    MoveWindow(hWindow, 0, 0, Wid, Hig, FALSE);
    GetClientRect(hWindow, R);
    IF Hig >= MaxH THEN
      BEGIN
        Inc(Wid, 48);
        Hig := OrgH;
      END;
    UNTIL R.Bottom-R.Top > 0;
    Dec(Hig, Hig1);
    MoveWindow(hWindow, 0, 0, Wid, Hig, TRUE);
  END;

```



Figure 11: Because the GroupMenu program is simply a menu, the function listed here sizes the window so only the menu shows.

the location of the icon.

GROUPVU's next step is to report on the items within the group. For each possible item, it calls the TGroupFile object's GetNthItem method. If this method returns TRUE, the variable TID now contains the TItemData structure for the requested item. GROUPVU reports the minimized location, item name, command line, and, if present, the hotkey. If the item is to be run minimized, it puts <m> before the item name.

Figure 9 shows an excerpt from GROUPVU's output (the complete output was over 200 lines long). In the

Startup group, note the two run-minimized items and the hotkey for Program Manager. The TGroupFile object has passed its test!

GROUPMEN: FILE MANAGER SURROGATE

Although GROUPVU is interesting, it's not especially useful. You might direct its output to the printer or to a file as a record of your .GRP file structure. Its main purpose however, was simply to test the TGroupFile object. With testing complete, let's move on to a new project: the GroupMenu program.

Do you get tired of peering at hieroglyphic icons, seeking the one that will

execute the program you need? Have you ever forgotten which ProgMan group contains a particular utility? I wrote GROUPMEN.EXE to provide menu-based access to all the programs that ProgMan manages. The top level menu items are group names, in alphabetical order, and the pop-up menus below them contain the names of programs in each group, again in alphabetical order. Click on Main, then click on Control Panel and the Control Panel opens. Select File! Find program and type part of a program name, and GROUPMEN will present you with each matching program and then run the one you choose. Space limitations prevent printing more than selected portions of the code in this column, however, both the complete GROUPMEN.PAS file and the compiled program GROUPMEN.EXE can be downloaded from PC MagNet. You should note that GroupMenu's use of the ShellExecute function means that GROUPMEN.EXE requires the Windows 3.1 SHELL.DLL.

GroupMenu is a typical OWL-based program in that it defines a TWindow descendant to be the program's main window. This descendant, TGroupMWindow, has a single data field, called commands, which is a pointer to a TNStrCollection object. The normal TStrCollection object holds a collection of strings that are automatically sorted in alphabetical order. TNStrCollection is a descendant of TStrCollection that suppresses the sorting by overriding the Compare method:

GROUPMEN.PAS

Partial Listing

```

PROCEDURE FindFile;
CONST
  Part1 : ARRAY[0..80] OF Char = '';
VAR
  MainB, SubB : ARRAY[0..80] OF Char;
  fnt         : ARRAY[0..1] OF PChar;
  MainH, SubH : hMenu;
  MsgLen,
  MainM, SubM,
  MainI, SubI : Word;
  Didit, Quit : Boolean;
  MsgBuff     : PChar;
BEGIN
  IF Application^.ExecDialog(New(PInputDialog,
    Init(Self, 'Find program', 'Partial name',
    part1, 80))) <> IDOK THEN Exit;
  MainH := GetMenu(hWindow);
  MainM := GetMenuItemCount(MainH);
  Didit := FALSE;
  Quit := FALSE;
  MainI := 1;
  fnt[0] := MainB;
  fnt[1] := SubB;
  WHILE (NOT (Didit OR Quit)) AND (MainI < MainM) DO
    BEGIN
      GetMenuString(MainH, MainI, MainB, 80, MF_BYPOSITION);
      SubH := GetSubMenu(MainH, MainI);
      SubM := GetMenuItemCount(SubH);
      SubI := 0;

```

```

      WHILE (NOT (Didit OR Quit)) AND (SubI < SubM) DO
        BEGIN
          GetMenuString(SubH, SubI, SubB, 80, MF_BYPOSITION);
          IF StrLIComp(part1, SubB, StrLen(part1)) = 0 THEN
            BEGIN
              MsgLen := StrLen(MainB) + StrLen(SubB) + 20;
              GetMem(MsgBuff, MsgLen);
              wvsprintf(MsgBuff, 'Group: %s'#$13'Program: %s', fnt);
              CASE MessageBox(hWindow, MsgBuff,
                'Execute program?', mb_YesNoCancel +
                mb_IconQuestion) OF
                id_Yes : BEGIN
                  Didit := TRUE;
                  ExecuteProgram(GetMenuItemId(
                    SubH, SubI)-cm_Progs);
                END;
                id_No : ;
                id_Cancel : Quit := TRUE;
              END;
              FreeMem(MsgBuff, MsgLen);
            END;
            Inc(SubI);
          END;
          Inc(MainI);
        END;
      IF NOT (Didit OR Quit) THEN
        MessageBox(hWindow, 'No more matching program names', Part1,
          mb_Ok + mb_IconInformation);
      END;

```



Figure 12: If you type a partial program name into FindFile's input dialog, it will locate and present any matching files in any group.

GROUPMEN.PAS

Partial Listing

```

PROCEDURE ExecuteProgram(Num : Word);
  (GRP file contains program name prefixed with *working*
   directory (if specified). Actual directory containing
   program is stored in tag data)
VAR
  ProgDir : ARRAY[0..fsPathName] OF Char;
  DefDir : ARRAY[0..fsDirectory] OF Char;
  ProgName : ARRAY[0..fsFileName] OF Char;
  ProgExt : ARRAY[0..fsExtension] OF Char;
  CmdLine : ARRAY[0..127] OF Char;
  P1, P2 : PChar;
  ShowCmd : Integer;
BEGIN
  P1 := commands^.At(Num);
  IF P1[0] = 'm' THEN ShowCmd := sw_ShowMinimized
  ELSE ShowCmd := sw_ShowNormal;
  IF P1[1] = '*' THEN
    BEGIN
      ProgDir[0] := #0;
      P2 := P1 + 3;
    END
  ELSE
    BEGIN
      P2 := StrScan(P1+1, ' ')+1;
      StrLCopy(ProgDir, P1+1, P2-P1-2);
    END;
  FileSplit(P2, DefDir, ProgName, ProgExt);
  StrCat(ProgDir, ProgName);
  StrCat(ProgDir, ProgExt);
  P1 := StrScan(P2, ' ');
  IF P1 = NIL THEN CmdLine[0] := #0
  ELSE StrCopy(CmdLine, P1+1);
  IF ShellExecute(hWnd, NIL, ProgDir, CmdLine,
    DefDir, ShowCmd) <= 32 THEN
    MessageBox(hWnd, ProgDir, 'CANNOT EXECUTE',
      mb_OK + mb_IconStop);
  END;
END;

```



Figure 13: The ExecuteProgram procedure calls the ShellExecute function from the Windows 3.1 SHELL.DLL to execute a program item in exactly the same manner as the Program Manager would do it.

```

FUNCTION TNStrCollection.Compare
(Key1, Key2 : Pointer) : Integer;
BEGIN
  Compare := -1;
END;

```

The commands collection stores the command line strings for all of the items in all of the active .GRP files.

TGroupMWindow's Init Constructor, listed in Figure 10, effectively duplicates most of the GROUPVU program. It starts by calling the inherited TWindow Constructor, initializing the commands collection, and loading the program's menu. The basic menu is only a file pop-up, but the Constructor will add more items.

Like GROUPVU, the Init Constructor checks each possible key in PROGMAN.INI, from Group1 through Group40, seeking .GRP filenames. For each .GRP file found, it initializes a TGroupFile object and adds all of the item names to a submenu, appending the hotkey string, if present, to the item name. Since there is no Windows API function that adds an alphabetized submenu, I wrote the simple function InsertMenuAlpha. This function flips through the existing menu items and inserts new items in alphabetical order.

At the same time as it inserts the item name into the menu, the Constructor builds a command line string to put in the commands collection. The first character of this string indicates whether the item is to be run minimized, using a small m for minimized, capital M for not minimized. Next comes the tag data directory (if present) or an asterisk (if not). The line ends with the command line value for

the item, preceded by a space. The calculation of each menu item's ID value is based on the number of items currently in the commands collection. Each command string is appended to that collection at a location corresponding to the ID value number. Thus, the menu item ID serves as an index to the item's command string in the commands collection.

The Constructor inserts the completed group submenu into the main menu as a pop-up, with the group name serving as the pop-up menu name. Again, the Constructor uses InsertMenuAlpha to put the group names in alphabetical

*Like GROUPVU, the Init
Constructor checks each
possible key in
PROGMAN.INI, from
Group1 through Group40,
seeking .GRP filenames.*

order. The File pop-up retains its initial position because its name actually begins with two spaces.

The menu is the *only* important part of GroupMenu, so the JustMenu method shown in Figure 11 sizes the window to display only the menu. Pass it the width of the screen as its Wid parameter and it will stretch the menu across the top of the screen. Pass a width of 0 and you get a vertical menu down the left side of the screen. Unfortunately, Windows provides no easy way to detect when a menu

has *wrapped* to multiple lines, and GroupMenu's menu is very likely to wrap. Therefore JustMenu sets a minimal window height, then repeatedly increases the height by the height of one menu line until the window's client area has a non-zero height. At that point it backs off by one menu-height, yielding a window that shows just a menu.

TGroupMWindow responds to all menu selections through its wmCommand message response method. In addition to the menu items that run programs, there are a number of special commands under the File menu. Find program locates a user-specified program; About displays the program's About box; Top Menu and Left Menu call the JustMenu method to move the menu to the top of the screen or to the left side; and Exit ends the program. Any other menu ID is a request to run a program.

Within the wmCommand method, the FindFile procedure listed in Figure 12 handles the task of locating files that begin with a user-specified string. It uses a standard single-line input dialog from the StdDigs unit to get the user's input. Note that since the string Part1 is actually a typed constant, it retains its value between invocations of this function, thereby always presenting the previous value as a default.

The rest of the FindFile function simply steps through the menu looking for program names (ignoring case) that start with the user's input string. If one is found, it puts up a yes/no/cancel MessageBox and waits for the user's response. Clicking on Cancel ends the search; No tells the function to keep looking; and Yes calls the ExecuteProgram

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★VideoSpigot for Windows

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★EZSound FX

EZSound FX is your complete audio enhancement utility for Windows 3.0 and 3.1, and supports all major sound cards. There is no need for special drivers or add-ons. Record and playback sound with the versatile stereo sound editor, jazz up your business presentations with background music, or relax while listening to your favorite CD while working in Windows. Customize your Windows environment, attach sounds to most Windows events, and much, much more! **Publisher: Future Trends** UT3043/5

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★WinSpeed

As a software-only accelerator, WinSpeed decreases the time it takes to build graphics images within Windows. So it speeds up your graphics-intensive applications by as much as 2 to 5 times. WinSpeed is compatible with most Windows applications and SuperVGA cards running in 256color modes. And if you aren't sure what type of SuperVGA you have, WinSpeed includes a special Auto Detection software which tells you if you have a complete SuperVGA. To maximize Windows performance, WinSpeed is an easy winner. One of *PC Magazine's* "Software, Best Utilities" 10/13/92. **Publisher: Panacea Inc.** UT2324

\$55

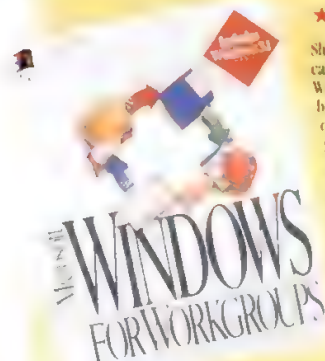
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★Windows for Workgroups

Share files, applications, and printers within a group. Send e-mail, manage calendars, schedule meetings - there are a host of ways that Windows for Workgroups can help you get more done. And nothing can do it more easily, because there's a Windows for Workgroups that's tailor-made for you, whether or not you have Windows 3.1, or you're currently on a network, or even if you just have DOS-based PCs. With its consistent interface, you'll have no trouble learning how to do any networking task. Simple icons make it easy to chat with a colleague or leave a message, check who's connected to your machine and what files they have open, and even share live data links with other network users. Also available: **Windows for Workgroups One-User** NT3963/5 \$59 **Publisher: Microsoft** Windows for Workgroups NT3953/5

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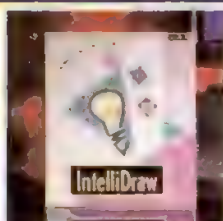
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Publisher: Aldus
GR5383

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Publisher:
WordPerfect
Corporation:
WP116245

\$269⁹⁵

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XTree Gold 2.5

XTree Gold 2.5 allows you to manage files, directories, and hard disks effortlessly. It has a handy Undelete utility, and an enhanced application menu with auto-build. Integrated file compression supports ZIP and ARJ, to save disk space. Complete file viewers for most popular applications display files in their native format. Publisher: XTree Company, 11814 499.

XTree For Windows

XTree for Windows is the essential companion to Microsoft Windows. Instantly copy, delete, move, rename and view files and directories with a single keystroke or mouse click. Open and arrange multiple windows to simultaneously view and manage files - including graphics files - without having to run the application that created them. Over 50 popular programs are supported. File compression is faster too. Supporting the industry standard ZIP format for fast, compatible file compression, XTreeLook is now included in XTree for Windows 4.

Publisher: XTree UT2785

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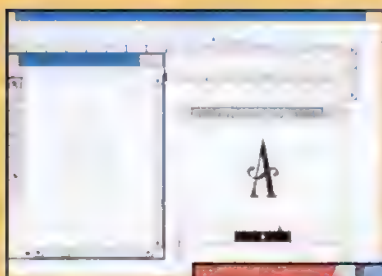
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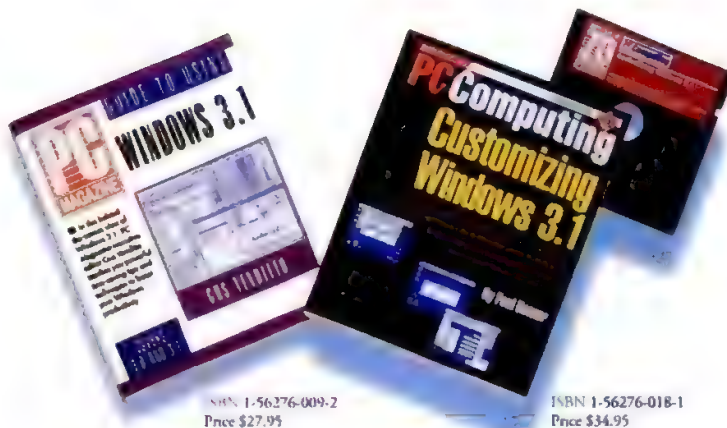
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function, which is listed in Figure 13.

`ExecuteProgram` is another sub-function of the `wmCommand` response method. It is called to run whatever program the user selects from the menu. This function starts by getting a pointer to the appropriate item in the commands collection. It checks the first character to see whether the program is to be run minimized, then extracts the tag data directory and command line from the string. Because of the way `ProgMan` stores the command line and working directory information, `ExecuteProgram` must remove the working directory from the command line and replace it with the tag data directory.

Once the necessary information is available in usable form, `ExecuteProgram` calls the `ShellExecute` API function, which is found in the Windows 3.1 `SHELL.DLL` library. `ShellExecute` loads the specified file in precisely the same way Program Manager does. If the main filename is not a program, `ShellExecute` automatically checks to see whether a program is associated with the files extension; if so, it runs that program. Note that the `ShellExecute` function can also be called to *print* a file, if you simply replace the `NIL` second parameter with the string "print".

DIGGING DEEPER INTO .GRP FILES By loading it from the Startup group, I keep `GROUPMEN` running on my system at all times. With its menus displayed across the top of the screen and Program Manager just below it, I have the freedom to run a program either by clicking on an icon *or* by picking from a menu. Of course, if I add, remove, or change program items, I must close and reinitialize `GroupMenu`, but that's rarely necessary.

The `GroupMenu` program demonstrates some, but by no means all, of the benefits of reading `.GRP` files. This issue's `WINTIDY` utility relies heavily on `GROUPFIL.PAS`. It extends the `TGroupFile` object, however, so that it can not only read `.GRP` files but—very carefully—write a few selected fields. Study the information here and in the `WINTIDY` article and you'll be able to make optimum use of the `.GRP` file information in your own programs. □

NEIL J. RUBENKING IS TECHNICAL EDITOR OF *PC MAGAZINE*.

Keep Your Program Manager Organized with WINTIDY

BY NEIL J. RUBENKING

Like many longtime computer users, I'm a keyboard whiz and a mouse wimp. The same fingers that type a hundred words a minute can't seem to double-click on a Program Manager icon without dislodging it. Changing the double-click time in the Control Panel doesn't help. And while Arrange Icons lines up the current group window's icons, it rearranges their placement.

The continual mess in my group windows prompted me to write WINTIDY, a utility that calls Arrange Icons for every ProgMan group window in turn. This utility was first published in my book, *PC Magazine Turbo Pascal for Windows Techniques and Utilities*, under the name PMTIDY.

The WINTIDY utility presented here is a much enhanced version of that program. It too can arrange the icons in every group window. In addition, it can save the ProgMan layout, including iconic location, normal window size, and display state (minimized, maximized, or normal) for each group window, along with the location of the items within each group window. If you experiment with a new layout, at the click of a button, WINTIDY will restore the ProgMan layout you last saved.

WINTIDY requires Windows 3.1, because some of the necessary programming functions were not introduced prior to that version. (Windows programmers will be amazed at the contortions this apparently simple program must go through behind the scenes.) And, of course, if you use a program other than Program Manager as your Windows shell, WINTIDY can't help you.

To get a copy of WINTIDY from PC MagNet, just follow the instructions in the sidebar "Utilities by Modem." For the executable program, download the

self-extracting archive WINTID.EXE from the Utilities/Tips Forum. WINTID.ZIP contains the complete source code for WINTIDY, including Pascal source, resource scripts, include files, and icon files. If you want to work from the source code, you'll need Borland Pascal 7.0 or Turbo Pascal for Windows (TPW) 1.5 to compile the program.

If you don't have a modem, you can still get the executable and source code files by sending a postcard with your name, address, and preferred disk size to

*Now you can arrange
all the items in Program
Manager neatly, saving
and later restoring
your complete layout
whenever you want.*

the attention of Katherine West, Utilities, *PC Magazine*, One Park Ave., New York, NY 10016. Or you can fax your request to 212-503-5799. No phone calls, please.

USING WINTIDY To install the program, simply copy WINTIDY.EXE into your utilities directory. If you wish, you can also copy the supplied WINTIDY.INI file into your Windows directory. (WINTIDY will create an .INI file there if it doesn't find one.) Then simply use the New command from ProgMan's File menu to install WINTIDY in the group of your choice.

WINTIDY's main menu consists of three items: File, Action, and Help. The File menu contains nothing but the standard Exit command, and the Help menu's two items display an About box

and a brief explanation of how to use WINTIDY. The screenshot in Figure 1 shows the program's Action menu, where you'll find Save Layout, Restore Layout, and Arrange Icons.

The first time you use WINTIDY, you'll probably want to start by selecting the Arrange Icons command. When you do so, the Program Manager will disappear for a moment and will then reappear with all of its group windows closed and all the group icons lined up in rows. If you now Open any group window, you'll find the icons inside will be nicely arranged in rows and columns.

From this orderly starting point, you can move the group window icons into an arrangement that makes sense to you. I like to put the group window icons along the top and left edges of the ProgMan window, leaving a large blank rectangular area. I can then open each group window and position it so it fits in that blank area. Your own preferred layout may differ, of course. After placing the group icons, open each group window, adjust its size and position, and locate the icons within the window to suit yourself. If one of the items in the group is used more than the others, you'll probably want to put it in the top left corner or in some other distinctive position.

When you've created the desired ProgMan layout, choose WINTIDY's Save Layout command. After a moment, WINTIDY should report success, and you'll find that it has created the file WINTIDY.INI in your Windows directory. This file follows the standard .INI format and so will serve as an easily readable record of your layout. I don't recommend that you edit this .INI file, however, for a mistake could render one of your groups or icons invisible.

Now, when hours or days of using ProgMan have made a muddle of your layout, just choose the Restore Layout



Figure 1: WINTIDY's Action menu lets you arrange all icons, save the current layout, or restore a saved layout.

command from the WINTIDY Action menu. Program Manager will disappear briefly, then reappear with everything arranged just as it was when you last saved the layout.

I should note that since WINTIDY must modify ProgMan's .GRP files when it restores a layout, a minor risk is involved. If something were to prevent WINTIDY from *completing* the modification, the binary .GRP file could be damaged, rendering the corresponding group inaccessible. The same thing would be true if, for example, the power failed while ProgMan itself was writing to a .GRP file. I suggest, therefore, that you copy your .GRP files to a backup directory right now and update your backup copies regularly.

WINTIDY obviously can't restore a group you have added since the last time you saved the layout. If the program encounters a new group during the restore process, it will report that fact in a message box. My suggestion for maintaining an orderly ProgMan window while adding new groups or program items would be to

- use WINTIDY to restore the saved layout,
- add the new program item or group and place it so as to fit into your layout, and then
- use WINTIDY to save the modified layout.

Keeping a single ProgMan layout isn't always enough. You might, for example, want to use one layout with 1,024-by-768 resolution and another for 640-by-480. And you may want to keep an existing layout safe while experimenting with a

new one. WINTIDY lets you do so simply by running it with an alternate .INI filename on its command line. Note that when you do this WINTIDY pays attention to the *filename* portion only; the utility supplies its own .INI extension. Thus, if you were to put C:\DOS\SNAFU.DAT on the command line, WINTIDY would interpret this as a request to use the file SNAFU.INI in the Windows directory.

When WINTIDY works with a layout file other than the default WINTIDY.INI, it appends the layout name to its title line. You can even compare layouts by running multiple copies of WINTIDY at once, each with its own layout file. Just select the Restore Layout command from each in turn to experiment with different layouts.

WINTIDY LAYOUT FILE STRUCTURE I chose the .INI file format for saving WINTIDY's layout data because so much of that data consists of variable length text strings. Besides, Windows itself has built-in support for .INI files, which simplifies the process of reading and writing the data. A WINTIDY.INI file always contains two sections: [Groups] and [Progman.Itself]. Each key in the [Groups] section is the name of a ProgMan group, and the key's value is a string of ten numbers that define a TWindowPlacement data structure for the group window. The [Progman.Itself] section has a single key, Placement, again with a value consisting

of ten numbers. This value defines ProgMan's own placement.

Every key in the [Groups] section is also the *name* of a section that holds information about that group. Each key in the latter sections is the name of a program item within the group, the key's value being the location of the item in the group window. Figure 2 contains a partial listing of a typical WINTIDY.INI file.

WINTIDY will behave a bit oddly in the rare event that you make a group that contains two program items with precisely the same name. Windows doesn't allow two keys with the same name in one section of an .INI file; the second simply overwrites the first. Even apart from this restriction, it's never a good idea to give the exact same name to different program items. If you *do*, however, and if you then save and restore the layout, WINTIDY will place the second item directly on top of the first!

A PROGRAMMING OVERVIEW WINTIDY performs only three tasks, each of which sounds easy enough. Surprisingly, however, in order to accomplish these tasks I had to employ three wildly different Windows programming techniques: Windows 3.1's Get/SetWindowPlacement functions; DDE (Dynamic Data Exchange) with ProgMan, using functions available only in Windows 3.1; and reading and writing to the .GRP files that store information about ProgMan groups. WINTIDY thus turned out to be much more of a programming exercise than I had expected, but Microsoft support experts have confirmed that there is no simpler way.

WINTIDY.INI

Partial Listing

```
[Groups]
Main=1;2;13,14;0,0;0,0,312,196
...

[Progman.Itself]
Placement=0;1;65535,65535;65535,65535;0,89,388,614

[Main]
MS-DOS Prompt=21,0
Control Panel=171,0
Windows Setup=246,0
File Manager=96,0
Print Manager=21,72
PIF Editor=96,72
Clipboard Viewer=171,72
...
```

Figure 2: A WINTIDY layout file contains the sections [Groups] and [Progman.Itself], together with a section for every group named in the [Groups] section.

Arranging all icons in ProgMan is the simplest WINTIDY action. WINTIDY first uses the API function FindWindow to locate Program Manager's window handle. The program then steps through ProgMan's menu until it finds the Arrange Icons item under the Window sub-menu, and it saves the command ID of that item. Next, it uses the EnumChildWindows API function to pass the window handle of each of ProgMan's child windows to a special callback function. This function checks to see whether the class name for the handle is *PMGroup*. If so, this is a group window, and the function stores the handle in an array. Finally, for each handle in the array, it opens the group window, sends ProgMan the command ID belonging to the Arrange Icons command, and closes the group window.

After successively processing all the group windows, WINTIDY sends the Arrange Icons command ID once more, this time to arrange the group icons themselves. Since it would take a noticeable amount of time to display all the group windows opening, arranging, and closing, WINTIDY hides ProgMan during this whole process.

WINTIDY uses two techniques specific to Windows 3.1 to save the current ProgMan layout. The GetWindowPlacement function takes a window handle and fills a TWindowPlacement data structure with information that includes the window's minimized location, normal size and position, and display state (minimized, maximized, or normal). (This structure is defined in Borland Pascal's Win31 unit.) To save the layout of the group windows, WINTIDY again uses EnumChildWindows, this time to get a list of all the group windows. For each group window, it calls GetWindowPlacement, converts the TWindowPlacement structure to a string of numbers, and writes the window name and placement string to the [Groups] section of the data file.

The only way to get the position of the program items *within* a group is to send

ProgMan a DDE request with the group name as its topic. This is a new feature of ProgMan in Windows 3.1. WINTIDY initiates a DDE conversation with ProgMan and requests data on each group in turn. From the block of text returned by ProgMan, WINTIDY extracts the name and position of each item and writes it to the .INI file section named for the current group.

The third and final task, restoring ProgMan's layout from a file, requires three steps, two of which depend specifically on Windows 3.1 functions. ProgMan will report the positions of group items via DDE, but the only way to *change* their positions is to write those changes into the .GRP file that defines the group. This issue's Lab Notes discusses the .GRP file format in detail and includes a Pascal ob-

ProgMan will report the positions of group items via DDE, but the only way to change their positions is to write those changes into the .GRP file that defines the group.

ject that can read and interpret the data in a .GRP file. WINTIDY uses a descendant of that object that adds a very limited ability to *write* to the .GRP file. It writes nothing but the new location for items that have changed position, and it adjusts the .GRP file's checksum so that the Program Manager will

not reject the changed file.

Before changing the .GRP files can have any effect, ProgMan must be told to reload the changed files. ProgMan can accept a number of commands via DDE, and Windows 3.1 adds a command to reload either one or all .GRP files. Thus, after adjusting the .GRP files, WINTIDY sends ProgMan a DDE message to execute the Reload command.

That takes care of restoring the position of items within the ProgMan groups. To restore the iconic position, normal size, and status of the group windows themselves, WINTIDY reverses the process it used to save that information. It acquires a list of group window handles, using the same callback function. For each group window, it reads the data string from the [Groups] section of the .INI file and converts the string back into a TWindowPlacement structure. Finally,

■ Utilities by Modem

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To obtain the current issue's utility free of charge: Dial the local number; at the HOST NAME prompt, type CIS; and at the USER ID prompt, enter 60116,1. Then at the PASSWORD prompt, enter PCMAG-UTIL.

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GROUPFWR.PAS

```

{$R-}
UNIT GroupFWrite;
{adds minimal WRITE ability to GroupFile object}
(**) INTERFACE (**)
{$IFDEF VER70}
{$Q-}
USES Objects,
{$ELSE}
USES WObjects,
{$ENDIF}
WinTypes, WinProcs, Win31, Strings, GroupType, GroupFile;

TYPE
  PGroupFilW = ^TGroupFilW;
  TGroupFilW = OBJECT(TGroupFile)
    Dirty : Boolean;
    CONSTRUCTOR Init(PName : PChar);
    DESTRUCTOR Done; Virtual;
    FUNCTION WriteNthItem(N : Word; TID : TItemData) : Boolean;
    PROCEDURE FixChecksum;
  END;

(**) IMPLEMENTATION (**)

CONSTRUCTOR TGroupFilW.Init(PName : PChar);
BEGIN
  TGroupFile.Init(PName);
  Dirty := FALSE;
END;

DESTRUCTOR TGroupFilW.Done;
BEGIN
  FixChecksum;
  TGroupFile.Done;

```

```

END;

FUNCTION TGroupFilW.WriteNthItem(N : Word; TID : TItemData) :
  Boolean;
{Valid for N from 0 to PGH^.cItems-1. If Nth item exists,
 writes Pt field from TID and returns TRUE; else FALSE.}
BEGIN
  IF PGH^.rgiItems[N] <> 0 THEN
    BEGIN
      WriteNthItem := TRUE;
      Dirty := TRUE;
      Seek(F, PGH^.rgiItems[N]);
      {ONLY write the Pt field}
      BlockWrite(F, TID, SizeOf(TPoint));
    END
  ELSE WriteNthItem := FALSE;
END;

PROCEDURE TGroupFilW.FixChecksum;
{Adjusts the wChecksum field of the header to take into account
 any changes to the GRP file}
VAR CSum : Word;
BEGIN
  IF NOT Dirty THEN Exit;
  CSum := CalcCkSum;
  IF CSum <> 0 THEN
    BEGIN
      Dec(PGH^.wChecksum, CSum);
      Seek(F, Ofs(PGH^.wChecksum) - Ofs(PGH^));
      BlockWrite(F, PGH^.wChecksum, SizeOf(Word));
    END;
  Dirty := FALSE;
END;
END.

```

Figure 3: The GroupFWrite unit defines an object that can write new item locations to ProgMan .GRP files.

it calls the SetWindowPlacement function to place the window.

I originally wrote WINTIDY as a standard Object Windows Library (OWL) based program, with a single TWindow descendant that implemented all of the program's functions. However, to make explaining the program easier, I expanded that one object into a hierarchy of four objects, each a descendent from the previous object, and each of which implements one portion of the program. The first three objects handle arranging icons, saving the layout, and restoring the layout, respectively. The final object binds these tasks to a simple user interface. Before digging more deeply into the source code that defines these objects, however, it's necessary to look at the object that handles access to .GRP files.

WRITING .GRP FILES As indicated, this issue's Lab Notes explores the complicated structure of the .GRP files that define ProgMan's group windows. The file structure is both intricate and fragile—changing the wrong byte can render the whole file useless. As a rule, therefore, although programs other than ProgMan itself may freely *read* a .GRP file, they should avoid *writing* to it. Unfortunately, WINTIDY can't accomplish its assigned tasks without breaking the rule. Still, it keeps .GRP file changes to an absolute minimum.

TGroupFile, a Pascal object defined in the file GROUPFIL.PAS (a file associated with this issue's Lab Notes), has the ability to read and interpret data from any valid .GRP file. WINTIDY uses a descendant of this object called TGroupFilW. This descendent object is defined in the file GROUPFWR.PAS, as shown in Figure 3. The new object adds but one data field—a Boolean called Dirty—that is initially set to FALSE in the object's Constructor. The WriteNthItem method of TGroupFilW is precisely parallel to the GetNthItem method of its ancestor. It locates the desired TItemData structure in the file, but it then *writes* new data instead of reading it. Only the first TItemData field, which defines the item's location, can be changed at will. Because almost all of the other fields are *offsets* to data elsewhere in the file, changing one of them would be disastrous. Therefore, WriteNthItem writes only as many bytes as are contained in the first data field. It also sets the object's data field Dirty to TRUE.

Before calling the inherited Destructor, which closes the .GRP file, TGroupFilW's Destructor calls the method FixChecksum. If anything has been changed in the file, this method calculates a new value for the wChecksum field in the .GRP file header and then writes the new value to the file. This particular step is absolutely necessary: ProgMan will reject

a .GRP file that doesn't have the right checksum value. You'll want to refer to the Lab Notes for more information on the .GRP file format and the TGroupFile object.

STEP ONE: ARRANGING ICONS As mentioned above, WINTIDY's main window functionality is spread over a series of four hierarchically derived objects. The first of these, TTidyWindowA, is defined in the file TIDYWINA.PAS, which is listed in Figure 4. Because TTidyWindowA is a descendant of the OWL object TDlgWindow, the resulting program uses a dialog box for its main window.

The data fields for this object are PMWindow, which holds the window handle for Program Manager itself, and THA, which is an array of 41 window handles used to store the group windows. In Windows 3.1 the maximum number of ProgMan group windows is 40; the very first element of the THA array tracks the number of elements that are actually in use. TTidyWindowA also has one private data field, ArrangeCmd, which is used to store the command ID that corresponds to the Arrange Icons menu choice in ProgMan.

TTidyWindowA's Init Constructor uses the API function FindWindow to locate ProgMan. Note that it looks for a window with the class name *Progman*, rather than one whose title is *Program*

Manager. This is because ProgMan's title can change. If any group window is maximized, for example, the group name is appended to the window title. Moreover, it's not difficult to change ProgMan's title—on my system I've named it Program Mangler!

Having found ProgMan's window handle, the Constructor calls the private method GetAACmd to locate the Arrange Icons command ID. This method first steps through the top level ProgMan menu until it finds the Window submenu, then steps through that submenu's items seeking the Arrange Icons selection. If it succeeds in finding this item, it sets the data field ArrangeCmd to the command ID associated with the item. If GetAACmd fails to find the desired command, the Constructor sets PMWindow to 0, which signals that the initialization failed.

TTidyWindowA's ArrangeAll method implements the technique out-

lined above for arranging all icons in ProgMan. Its first step is to call the GetGroupHandles method to fill the THA array with the handles of all group windows. Because group windows can be added or removed at any time, this step must be repeated whenever ArrangeAll is called.

GetGroupHandles first uses FillChar to zero out the THA array. It then calls the EnumChildWindows API function, which passes each child window of Program Manager to the callback function GetGroup. The "smart callback" feature invoked by the \$K+ compiler directive in Borland Pascal makes it possible to pass the address of GetGroup directly to EnumChildWindows. In TPW 1.5, on the other hand, you'll have to create a procedure instance of the callback function, pass the instance to EnumChildWindows, and then free the instance. Either way, GetGroup checks each child window to see whether its window class name

is PMGroup; if so, it stores the window handle in the THA array.

After getting the group window handles, ArrangeAll steps through the array, calling the subprocedure ArrangeOne for each handle. The ArrangeOne procedure opens the group window, sends ProgMan the stored command ID to arrange icons, and then closes the group window. When all the group windows have been processed and closed, ArrangeAll sends the command ID to ProgMan once more, this time arranging the group icons. Having completed its task, ArrangeAll reports its success to the user.

The MessageBox function call that reports the method's success includes the constant mb_IconInformation, which causes the message box to include an icon. ArrangeAll passes that same constant to the MessageBeep function before displaying the message box. On a multimedia-equipped system, this tells Windows to play the .WAV file associ-

TIDYWINA.PAS

```
{IFDEF VER70}
{$K+}
{$ENDIF}
UNIT TidyWinA;
(**) INTERFACE (**)
USES WinTypes, WinProcs, Strings, Win31, (IFDEF VER70) WObjects;
{$ELSE} ODialogs, OWindows, Objects;{$ENDIF}
CONST
  MaxGroups = 40; {Win 3.1 supports a maximum of 40 ProgMan groups}
TYPE
  PHwndArray = ^THwndArray;
  THwndArray = ARRAY[0..MaxGroups] OF Hwnd;

  PTidyWindowA = ^TTidyWindowA;
  TTidyWindowA = OBJECT(TDlqWindow)
    PMWindow : Hwnd;
    THA : THwndArray;
    Quiet : Boolean;
    OldCur : HCursor;
    CONSTRUCTOR Init(AParent : PWindowsObject; AName : PChar);
    PROCEDURE GetGroupHandles;
    PROCEDURE ArrangeAll;
    (**) PRIVATE (**)
    ArrangeCmd : Word;
    PROCEDURE GetAACmd;
  END;

  FUNCTION GetGroup(H : Hwnd; PHA : PHwndArray) : Boolean; EXPORT;

(**) IMPLEMENTATION (**)
FUNCTION GetGroup(H : Hwnd; PHA : PHwndArray) : Boolean;
{callback function used in saving layout of groups}
VAR CBuf : ARRAY[0..12] OF Char;
BEGIN
  GetGroup := TRUE; {continue enumerating}
  GetClassName(H, CBuf, 12);
  {if this is a group window, collect its handle}
  IF (StrComp(CBuf, 'PMGroup') = 0) AND (PHA[0] < 40) THEN
    BEGIN
      Inc(PHA[0]);
      PHA[PHA[0]] := H;
    END;
  END;
END;

CONSTRUCTOR TTidyWindowA.Init(AParent : PWindowsObject;
  AName : PChar);
BEGIN
  TDlqWindow.Init(AParent, AName);
  Quiet := FALSE;
  PMWindow := FindWindow('Progman', NIL);
  GetAACmd;
  IF ArrangeCmd = 0 THEN PMWindow := 0;
END;

PROCEDURE TTidyWindowA.GetGroupHandles;
VAR theInst : TParProc;

BEGIN
  {Fill the array with the handles of all the group windows}
  FillChar(THA, SizeOf(THA), 0);
  {IFDEF VER70} {use BP smart callbacks if available}
  EnumChildWindows(PMWindow, @GetGroup, LongInt(@THA));
  {$ELSE}
  TheInst := MakeProcInstance(@GetGroup, hInstance);
```

```
EnumChildWindows(PMWindow, theInst, LongInt(@THA));
FreeProcInstance(theInst);
{$ENDIF}
END;

PROCEDURE TTidyWindowA.ArrangeAll;
VAR N : Word;

PROCEDURE ArrangeOne(H : Hwnd);
BEGIN
  ShowWindow(H, sw_Restore);
  SendMessage(PMWindow, WM_Command, ArrangeCmd, 0);
  ShowWindow(H, sw_ShowMinimized);
END;

BEGIN
  IF PMWindow = 0 THEN Exit;
  OldCur := SetCursor(LoadCursor(0, 1dc_Wait));
  SetCapture(hWindow);
  GetGroupHandles;
  {arrange icons in each group window}
  ShowWindow(PMWindow, sw_Hide);
  FOR N := 1 TO THA[0] DO ArrangeOne(THA[N]);
  ShowWindow(PMWindow, sw_Show);
  {arrange icons of group windows themselves}
  SendMessage(PMWindow, WM_Command, ArrangeCmd, 0);
  IF NOT Quiet THEN MessageBeep(mb_IconInformation);
  MessageBox(hWindow, 'All icons arranged', 'WINTIDY',
    mb_OK + mb_IconInformation);
  SetCursor(OldCur);
  ReleaseCapture;
END;

PROCEDURE TTidyWindowA.GetAACmd;
CONST bSize = 20;
VAR
  MainM, SubM : HMenu;
  count, N : Word;
  mBuff : ARRAY[0..bSize] OF Char;
BEGIN
  ArrangeCmd := 0;
  IF PMWindow = 0 THEN Exit;
  MainM := GetMenu(PMWindow);
  Count := GetMenuItemCount(MainM);
  SubM := 0;
  FOR N := 0 TO pred(Count) DO
    BEGIN
      GetMenuString(MainM, N, mBuff, bSize, mf_ByPosition);
      IF StrLIComp(mBuff, '&Arrange Icons', 14) = 0 THEN
        SubM := GetSubMenu(MainM, N);
      END;
    END;
  IF SubM = 0 THEN Exit;
  Count := GetMenuItemCount(SubM);
  FOR N := 0 TO pred(Count) DO
    BEGIN
      GetMenuString(SubM, N, mBuff, bSize, mf_ByPosition);
      IF StrLIComp(mBuff, '&Arrange Icons', 14) = 0 THEN
        ArrangeCmd := GetMenuItemID(SubM, N);
      END;
    END;
  END;
END.
```

Figure 4: The TTidyWindowA object, first in a hierarchy of four objects, implements WINTIDY'S Arrange Icons command.

ated with the Asterisk event. Since WINTIDY always makes the appropriate MessageBeep call before calling MessageBox, in a small way it's multimedia-aware! (In order to *suppress* the audible notification, add a /Q switch to the WINTIDY command line.)

STEP TWO: SAVING A PROGMAN LAYOUT The TIDYWINB.PAS source file, listed in Figure 5, defines TTidyWindowB, which is a descendant of TTidyWindowA. This object inherits all the methods and data fields of TTidyWindowA while adding new fields and methods that can save the current ProgMan layout to disk.

The LinkedToPM data field, which is set to FALSE by the object's Constructor, is TRUE only *during* a DDE conversation with ProgMan. IniName points to a string that contains the name of the .INI file in which to store the layout. TTidyWindowB leaves the task of assigning a value for IniName to its descendants. In DDE messages, strings are passed by putting them in the global atom table, and in WINTIDY three TAtom data fields are used by the DDE conversation. CurrGrp in Figure 5 is simply an index that is used to step through the list of group windows and to request data about each from ProgMan.

The TTidyWindowB object adds a

■ PC Magazine Utilities Updates

As with all good software, the programs presented in *PC Magazine* are upgraded and improved. Here's a partial list of the programs on PC MagNet that have been updated. To download these files from the Utilities/Tips Forum, type GO ZNT: TIPS, type LIB or select Libraries from the menu, then select Library 2 PCMAG UTILS. Type DOW and the filename listed below (for example, DOW ANSI.COM), or select Download a File from the menu.

ADDIT.COM, Version 1.1
ANSI.COM, Version 1.3
BAT2EXEC.COM, Version 1.5
BCOPY, Version 1.2
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.7
CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 3.1

EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
PCACCESS.EXE, Version 1.1
RN.COM, Version 3.0
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.4

For a list of the programs that are available on PC MagNet, download the file PCMCAT.ZIP from Library 1 (General Information) of the Utilities/Tips Forum.

A downloadable index to *PC Magazine's* product reviews is also available in Library 1 (General Info). PCM.EXE is a self-extracting file containing the Computer Library *PC Magazine* Reviews Index for January 1988 through December 1991. It requires the search files in PCSRCH.EXE.

simple Destructor that sends a wm_DDE_Terminate message to ProgMan if the program should get shut down during the conversation. That possibility should never be realized, however, because the CanClose method returns FALSE during a conversation.

The actual process of storing the current layout to disk begins with a call to the SaveLayout method. As with

ArrangeAll, this method exits immediately if the PMWindow field is zero, for that would mean that the object had failed to locate the Program Manager. The first step in saving the layout is to clear out old values from the .INI file. This task is handled by the ClearIniFile subprocedure. The procedure loads a list of all keys in the .INI file's [Groups] section into memory and then clears the

TIDYWINB.PAS

1 of 2

```
UNIT TidyWinB;
(**) INTERFACE (**)
USES WinTypes, WinProcs, Strings, Win31, TidyWinA,
($IFDEF VER70) ODialogs, OWindows, Objects;
($ELSE) WObjects; ($ENDIF)
CONST
  ServerName = 'PROGMAN';
  TopicName = 'PROGMAN';
  GroupSect = 'Groups';
  ProgmansSect = 'Progmans.Itself';
  (DDE constants)
  fResponse = $1000;
  fRelease = $2000;
  reserved = $4000;
  fAckReq = $8000;
TYPE
  PTidyWindowB = ^TTidyWindowB;
  TTidyWindowB = OBJECT(TTidyWindowA)
    LinkedToPM : Boolean;
    IniName : PChar;
    TAserver,
    TAtopic, TAGroup : TAtom;
    CurrGrp : Word;
    CONSTRUCTOR Init(AParent : PWindowsObject; AName : PChar);
    DESTRUCTOR Done; Virtual;
    FUNCTION CanClose : Boolean; Virtual;
    PROCEDURE SaveLayout;
    PROCEDURE InitDDEConversation;
    PROCEDURE Converse; Virtual;
    PROCEDURE WmDDEAck(VAR Msg : TMessage); Virtual;
    vm_First + wm_DDE_Ack;
    PROCEDURE WmDDEData(VAR Msg : TMessage); Virtual;
    vm_First + wm_DDE_Data;
    PROCEDURE WmDDETerminate(VAR Msg : TMessage); Virtual;
    vm_First + wm_DDE_Terminate;
  END;
(**) IMPLEMENTATION (**)
CONSTRUCTOR TTidyWindowB.Init(AParent : PWindowsObject;
  AName : PChar);
BEGIN
  TTidyWindowA.Init(AParent, AName);
```

```
  LinkedToPM := FALSE;
END;
DESTRUCTOR TTidyWindowB.Done;
BEGIN
  IF LinkedToPM THEN PostMessage(PMWindow, wm_DDE_Terminate,
    hWindow, 0);
  TTidyWindowA.Done;
END;
FUNCTION TTidyWindowB.CanClose : Boolean;
BEGIN
  IF LinkedToPM THEN
    BEGIN
      CanClose := FALSE;
      IF NOT Quiet THEN MessageBeep(mb_IconInformation);
      MessageBox(hWindow, 'Patience - DDE conversation still '+
        'in progress.', 'WINTIDY', mb_OK + mb_IconInformation);
    END
  ELSE CanClose := TRUE;
END;
PROCEDURE TTidyWindowB.SaveLayout;
VAR N : Word;
PROCEDURE ClearIniFile;
CONST bSize = MaxGroups*50; (est. max 50 chars per name)
VAR SecBuff, P : PChar;
BEGIN
  GetMem(SecBuff, bSize);
  (fill SecBuff with all keys from Groups section, separated by
  $0 and ending with a double $0)
  GetPrivateProfileString(GroupSect, NIL, '', SecBuff,
    bSize, IniName);
  P := SecBuff;
  ('walk' P through the list)
  WHILE P[0] <> $0 DO
    BEGIN
      (Clear items section for this group)
      WritePrivateProfileString(P, NIL, NIL, IniName);
      P := StrEnd(P) + 1;
    END;
```

Figure 5: The TTidyWindowB object handles WINTIDY'S Save Layout command.

TIDYWINB.PAS

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```

    em(SecBuff, bSize);
    ear the existing Groups section)
    PrivateProfileString(GroupSect, NIL, NIL, IniName);
    ear the ProgMan section)
    PrivateProfileString(ProgmanSect, NIL, NIL,
    .Name);

JRE WriteOneLocation(IsGroup : Boolean; H : HWND);

se = 80;
se = 60;

Buf : ARRAY[0..nBSize] OF Char;
    : PChar;
    : TWindowPlacement;
uf : ARRAY[0..tBSize] OF Char;

aGroup THEN
GIN
GetWindowText(H, NameBuf, nBSize);
Sect := GroupSect;
ID
;
GIN
StrCopy(NameBuf, 'Placement');
Sect := ProgmanSect;
ID;
Just set TWP.length before calling GetWindowPlacement)
TP.length := SizeOf(TWP);
stWindowPlacement(H, @TWP);
sprintf(TWPBuf, '%u;%u;%u;%u;%u;%u;%u;%u;%u;%u', TWP.flags);
itePrivateProfileString(Sect, NameBuf, TWPBuf, IniName);
;

pmWindow = 0 THEN Exit;
Cur := SetCursor(LoadCursor(0, 0));
Capture(hWindow);
arIniFile;
GroupHandles;
write location data for each group window, and ProgMan too;
N := 1 TO THA[0] DO WriteOneLocation(TRUE, THA[N]);
teOneLocation(FALSE, PMWindow);
rGrp := 0;
tDDEConversation;

PROCEDURE TTidyWindowB.InitDDEConversation;
{Initiate a DDE conversation with ProgMan}
TAServer := GlobalAddAtom(ServerName);
TATopic := GlobalAddAtom(TopicName);
{ProgMan will respond with WM_DDE_Ack}
SendMessage(pmWindow, WM_DDE_INITIATE, hWindow,
MakeLong(TAServer, TATopic));
GlobalDeleteAtom(TATopic);
GlobalDeleteAtom(TAServer);
END;

PROCEDURE TTidyWindowB.WMDDEAck(VAR Msg : TMessage);
{Should receive one Ack upon initiating conversation.}
BEGIN
IF NOT LinkedToPM THEN
BEGIN
LinkedToPM := TRUE;
TAServer := Msg.LParamLo;
TATopic := Msg.LParamHi;
PMWindow := Msg.WParam;
IF TAServer <> 0 THEN GlobalDeleteAtom(TAServer);
IF TATopic <> 0 THEN GlobalDeleteAtom(TATopic);
Converse;
END
ELSE
BEGIN
IF (Msg.LParamLo AND dde_Ack) <> dde_Ack THEN
BEGIN
IF NOT Quiet THEN MessageBeep(mb_IconStop);
MessageBox(hWindow, 'Program Manager does not'+
' acknowledge command', 'ERROR',
mb_IconStop);
SetCursor(OldCur);
ReleaseCapture;
END;
GlobalDeleteAtom(Msg.LParamHi);
END;
END;

```

```

PROCEDURE TTidyWindowB.Converse;
CONST nBSize = 80;
VAR NameBuf : ARRAY[0..nBSize] OF Char;
BEGIN
Inc(CurrGrp);
IF CurrGrp <= THA[0] THEN
BEGIN
GetWindowText(THA[CurrGrp], NameBuf, nBSize);
TAGroup := GlobalAddAtom(NameBuf);
{ProgMan will respond with WM_DDE_Data}
PostMessage(PMWindow, WM_DDE_REQUEST, hWindow,
MakeLong(cf_Text, TAGroup));
END
ELSE
BEGIN
IF NOT Quiet THEN MessageBeep(mb_IconInformation);
MessageBox(hWindow, 'Layout has been saved in INI file',
IniName, mb_OK + mb_IconInformation);
PostMessage(PMWindow, WM_DDE_TERMINATE, hWindow, 0);
SetCursor(OldCur);
ReleaseCapture;
END;
END;

PROCEDURE TTidyWindowB.WMDDEData(VAR Msg : TMessage);
VAR
PTD : PDDEData;
Release : Boolean;
PData, GrpName,
ItemP, NextItem,
NameP : PChar;
Len, M : Word;
BEGIN
PTD := GlobalLock(Msg.LParamLo);
Release := PTD.Flags AND fRelease > 0;
GlobalDeleteAtom(Msg.LParamHi);
PData := @PTD.Value;
Len := StrLen(PData);
(replace CR/LF with #0#0, so can use StrEnd to "walk" the list)
FOR M := 0 TO pred(Len) DO
IF (PData[M] = #13) OR (PData[M] = #10) THEN
PData[M] := #0;
(point ItemP to first line of ITEM data, after GROUP data)
ItemP := StrEnd(PData)+2;
(point GrpName past initial quotemark...)
GrpName := PData+1;
(... and chop it off at next quotemark)
StrScan(GrpName, '"') := #0;
{If ItemP empty, there ARE no items}
IF ItemP[0] = #0 THEN
BEGIN
IF NOT Quiet THEN MessageBeep(mb_IconInformation);
MessageBox(hWindow, 'Note: Group contains NO program items',
GrpName, mb_OK + mb_IconInformation);
END
ELSE
{now record the individual item data}
REPEAT
{Note location of NEXT item before we chop up this item}
NextItem := StrEnd(ItemP)+2;
NameP := ItemP+1; {skip initial quotemark}
ItemP := StrScan(NameP, '"') + 2;
{NameP points to item name - chop it off at quote}
StrScan(NameP, '"') := #0;
{ItemP points at path after quoted name. skip over three
commas to reach location data}
ItemP := StrScan(ItemP, ',')+1;
ItemP := StrScan(ItemP, ',')+1;
ItemP := StrScan(ItemP, ',')+1;
{insert #0 at 2nd comma}
StrScan(StrScan(ItemP, ',')+1, ',') := #0;
{record item name as key, location as value}
WritePrivateProfileString(GrpName, NameP, ItemP, IniName);
ItemP := NextItem;
UNTIL ItemP-PData >= Len;
GlobalUnlock(Msg.LParamLo);
IF Release THEN GlobalFree(Msg.LParamLo);
Converse;
END;

PROCEDURE TTidyWindowB.WMDDETerminate(VAR Msg : TMessage);
BEGIN
LinkedToPM := FALSE;
END;
END.

```

group corresponding to each key. To delete a group in the .INI file, it calls the API function `WritePrivateProfileString` with NIL for the key name and value. Next, it uses the same technique to clear the [Groups] section and the [Progman.Itself] section. This serves to empty the .INI file of data without wiping out any comments.

After clearing the .INI file, `SaveLayout` calls the inherited method `GetGroupHandles` to fill the THA array with the window handles of all the group win-

dows. `SaveLayout` then passes each of the window handles to the subprocedure `WriteOneLocation`. This procedure uses the Windows 3.1 function `GetWindowPlacement` to fill a `TWindowPlacement` structure with information about the window. Note that it is necessary to set the length field of the `TWindowPlacement` structure before making this call.

All the fields of a `TWindowPlacement` structure are either Words or other structures that are composed solely of Words. That makes it easy to convert the struc-

ture into a string: A single call to the `wsprintf` API function does the job. The subprocedure writes an entry in the .INI file's [Groups] section, entering the group window name as the key and the window placement string as its value. After processing all of the groups, `SaveLayout` calls the `WriteOneLocation` procedure a final time to save placement data for ProgMan.

Getting the location of the items *within* each group is a more difficult matter; in fact, it's possible only in Windows

Typical Data Block

```
"Main",E:\WINDOWS\MAIN.GRP,7,7
"MS-DOS Prompt","DOSPRMT.PIF",,E:\WINDOWS\PROGMAN.EXE,21,0,9,0,0
"Control Panel","CONTROL.EXE",,E:\WINDOWS\CONTROL.EXE,96,0,0,0,0
"Windows Setup","SETUP.EXE",,E:\WINDOWS\SETUP.EXE,171,72,0,0,0
"File Manager","WINFILE.EXE",,E:\WINDOWS\WINFILE.EXE,171,0,0,0,0
"Print Manager","PRINTMAN.EXE",,E:\WINDOWS\PRINTMAN.EXE,21,72,0,0,0
"PIF Editor","PIFEDIT.EXE",,E:\WINDOWS\PIFEDIT.EXE,96,72,0,0,0
"Clipboard Viewer","CLIPBRD.EXE",,E:\WINDOWS\CLIPBRD.EXE,246,0,0,0,0
```

Figure 6: A typical data block sent by ProgMan in response to a DDE request.

3.1. The last line of `SaveLayout` calls the `InitDDEConversation` method, which requests a DDE conversation with ProgMan. The method creates atoms for the server name and the topic name (both *PROGMAN*). It then passes these names in a `wm_DDE_Initiate` message to Program Manager's window. In this case, the value of `PMWindow` has already been determined in the `Init` Constructor of `TTidyWindowA`. Lacking that information, the program could simply broadcast its DDE request by using the window handle `$FFFF`. The first matching DDE server would then respond by passing its own window handle with the `wm_DDE_Ack` message.

Normally, a program requesting a

DDE conversation would have to deal with the possibility that no server would respond to the message. It might set a timer and call the attempt a failure if a certain time elapsed without any response. However, since *WINTIDY* couldn't have gotten this far without already being sure that ProgMan was loaded, it simply looks for ProgMan's acknowledgement of the request in a `wm_DDE_Ack` message.

If the `LinkedToPM` field is `FALSE` when `TTidyWindowB`'s `wmDDEAck` method is called, it means that this message is a response to the request to initiate a conversation. `WmDDEAck` sets `LinkedToPM` to `TRUE`, deletes the passed atoms, and calls the `Converse`

method instead. `WmDDEAck` also sets `PMWindow` to the window handle that was passed in the message's `wParam`. This last is not strictly necessary here, but it would be in a program that had to broadcast the original `wm_DDE_Initiate` message to all DDE servers.

`Converse` is a virtual method, so if a descendant of `TTidyWindowB` overrides it, the `wmDDEAck` method will call the descendant's `Converse` method. In this case, each call to `Converse` sends ProgMan a `wm_DDE_Request` message asking for information on the next group window, as defined by the variable `CurrGrp`. ProgMan should respond with a `wm_DDE_Data` message that contains a handle to a block of text describing the specified group. If all group windows have been processed, `Converse` indicates its success and then sends ProgMan a message terminating the conversation.

`TTidyWindowB`'s `wmDDEData` method responds to the data message from ProgMan, which contains a handle to a `TDDEData` structure. The value field of this structure is yet another handle, this one pointing to a memory block

TIDYWINC.PAS

1 of 2

```
UNIT TidyWinC;
(**) INTERFACE (**)
USES WinTypes, MinProc, Strings, Win31, TidyWinA, TidyWinB,
  GroupType, GroupFWrite, ($IFDEF VER70) WObjects;
($ELSE) ODialogs, OWindows, Objects; ($ENDIF)
TYPE
  TTidyWindowC = ^TTidyWindowC;
  TTidyWindowC = OBJECT(TTidyWindowB)
    Reloading : Boolean;
    CONSTRUCTOR Init(AParent : PWindowsObject; AName : PChar);
    PROCEDURE RestoreLayout;
    PROCEDURE Converse; Virtual;
    PROCEDURE WmDDEAck(VAR Msg : TMessage); Virtual;
    WmFirst + Wm_DDE_Ack;
    FUNCTION LocateFromINI(IsGroup : Boolean; H : HWND) : Boolean;
    PROCEDURE RestoreGroupWindows;
  END;

(**) IMPLEMENTATION (**)
CONSTRUCTOR TTidyWindowC.Init(AParent : PWindowsObject;
  AName : PChar);
BEGIN
  TTidyWindowB.Init(AParent, AName);
  Reloading := FALSE;
END;

PROCEDURE TTidyWindowC.RestoreLayout;
CONST
  GroupX : PChar = 'GROUPxx';
  gBSize = 80;
VAR
  GroupNum, HwndNum,
  ItemNum : Word;
  GroupBuf, GpNameBuf : ARRAY[0..gBSize] OF Char;
  TGF : TGroupFile;
  TWP : TWindowPlacement;
  TID : TItemData;

  FUNCTION UpdateItem : Boolean;
  CONST
    nBSize = 80;
    pBSize = 14;
  VAR
    ItemNameBuf : ARRAY[0..nBSize] OF Char;
    PosnBuf : ARRAY[0..pBSize] OF Char;
    Px,Py : PChar;
    vx,vY,Code : Integer;
    L : Longint;
  BEGIN
    UpdateItem := FALSE;
    TGF.PCharFmOffset(TID.pName, ItemNameBuf, nBSize);
    GetPrivateProfileString(gpNameBuf, ItemNameBuf, '', PosnBuf,
      pBSize, IniName);
    IF PosnBuf[0] <> #0 THEN
```

```
BEGIN
  Px := PosnBuf;
  Py := StrScan(PosnBuf, ',') + 1;
  Px[Py-Px-1] := #0;
  Val(Px, L, Code);
  IF Code <> 0 THEN Exit;
  IF (L < -32768) OR (L > 32767) THEN Exit;
  vx := L;
  Val(Py, L, Code);
  IF Code <> 0 THEN Exit;
  IF (L < -32768) OR (L > 32767) THEN Exit;
  vY := L;
  WITH TID.Pt DO
    IF (X <> vx) OR (Y <> vY) THEN
      BEGIN
        UpdateItem := TRUE;
        X := vx; Y := vY;
      END;
    END;
  END;

END;

BEGIN
  IF pmWindow = 0 THEN Exit;
  OldCur := SetCursor(LoadCursor(0, IDC_WAIT));
  SetCapture(hWindow);
  {restore ProgMan's size and position}
  IF NOT LocateFromINI(FALSE, PMWindow) THEN Exit;
  {restore item positions in GRP files}
  ShowWindow(PMWindow, SW_HIDE);
  FOR GroupNum := 1 TO MaxGroups DO
    BEGIN
      wvprintf(GroupX, 'Group%u', GroupNum);
      GetPrivateProfileString('Groups', GroupX, '', GroupBuf,
        gBSize, 'PROGMAN.INI');
      IF GroupBuf[0] <> #0 THEN
        BEGIN
          TGF.Init(GroupBuf);
          TGF.fpName(gpNameBuf, gBSize);
          FOR ItemNum := 0 TO TGF.fcItems-1 DO
            IF TGF.GetNthItem(ItemNum, TID) THEN
              IF UpdateItem THEN
                TGF.WriteNthItem(ItemNum, TID);
          TGF.Done;
        END;
      END;
    END;
  {initiate DDE conversation with ProgMan}
  Reloading := TRUE;
  InitDDEConversation;
END;

FUNCTION TTidyWindowC.LocateFromINI(IsGroup : Boolean; H : HWND) :
  Boolean;
CONST
  nBSize = 80;
```

Figure 7: The `TTidyWindowC` object rounds out *WINTIDY*'s functions by implementing the ability to restore ProgMan's layout from disk.


```

END;
END;

PROCEDURE TTidyWindowC.Converse;
{If Reloading from INI file, send a Reload command to ProgMan.
Otherwise, let the default behavior of TTidyWindowB happen.}
CONST ReloadCmd = '[Reload]';
VAR
  PMcmdH : THandle;
  PMcmdP : PChar;
BEGIN
  IF Reloading THEN
    BEGIN
      PMcmdH := GlobalAlloc(gmem_Moveable OR gmem_DDEShare,
        StrLen(ReloadCmd));
      PMcmdP := GlobalLock(PMcmdH);
      StrCopy(PMcmdP, ReloadCmd);
      GlobalUnlock(PMcmdH);
      IF NOT PostMessage(PMWindow, wm_DDE_Execute,
        hWindow, MakeLong(0, PMcmdH)) THEN
        GlobalFree(PMcmdH);
      END
    END
  ELSE TTidyWindowB.Converse;
END;

PROCEDURE TTidyWindowC.wmDDEack(VAR Msg : TMessage);
{If not Reloading from INI file, let TTidyWindowB handle it.
Otherwise, let TTidyWindowB handle the FIRST Ack, and take
the next as a signal to END the conversation}
BEGIN
  IF NOT Reloading THEN TTidyWindowB.wmDDEack(Msg)
  ELSE IF NOT LinkedToPM THEN TTidyWindowB.wmDDEack(Msg)
  ELSE
    BEGIN
      GlobalDeleteAtom(Msg.lParamHi);
      Reloading := FALSE;
      IF Msg.lParamLo AND dde_Ack <> dde_Ack THEN
        BEGIN
          IF NOT Quiet THEN MessageBeep(mb_IconStop);
          MessageBox(hWindow, 'Program Manager does not'+
            ' acknowledge command', 'ERROR',
            mb_OK + mb_IconStop);
          SetCursor(OldCur);
          ReleaseCapture;
        END
      ELSE
        BEGIN
          PostMessage(PMWindow, wm_DDE_Terminate, hWindow, 0);
          RestoreGroupWindows;
        END;
      END;
    END;
  END;

END;

PROCEDURE TTidyWindowC.RestoreGroupWindows;
VAR M : Word;
BEGIN
  GetGroupHandles;
  FOR M := 1 TO THA[0] DO LocateFromINI(TRUE, THA[M]);
  ShowWindow(PMWindow, sw_Show);
  IF NOT Quiet THEN MessageBeep(mb_IconInformation);
  MessageBox(hWindow, 'Layout has been restored from INI file',
    IniName, mb_OK + mb_IconInformation);
  SetCursor(OldCur);
  ReleaseCapture;
END;
END.

```

The `RestoreLayout` method exits immediately if the value of `PMWindow` is 0. Its next step is to make a call to the `LocateFromINI` method to try to restore the window placement of `ProgMan` itself from data contained in the .INI file. If this attempt fails, then the .INI file is either missing or corrupted, and the restoration process ends. The `LocateFromINI` method is exactly the opposite of the

WINTIDY.PAS

```

PROGRAM WinTidy;
USES WinTypes, WinProcs, Strings, Win31, WinDOS, TidyWinA, TidyWinB,
    TidyWinC, ($IFDEF VER70) ODialogs, OWindows, Objects;
($ELSE) WObjects; ($ENDIF)
($D Copyright (c) 1992 by Neil J. Rubenking)
($R WINTIDY)
($I WINTIDY.INC)
CONST AppName : PChar = 'WinTidy';
TYPE
    TMyApplication = OBJECT(TApplication)
        PROCEDURE InitMainWindow; virtual;
    END;

    PTidyWindow = ^TTidyWindow;
    TTidyWindow = OBJECT(TTidyWindowC)
        CONSTRUCTOR Init(AParent : PWindowsObject; AName : PChar);
        DESTRUCTOR Done; virtual;
        PROCEDURE SetUpWindow; virtual;
        FUNCTION GetClassName : PChar; virtual;
        PROCEDURE GetWindowClass(var AWndClass: TWndClass); virtual;
        PROCEDURE WmCommand(VAR Msg : TMessage); virtual
            Wm_First + Wm_Command;
    END;

    PBitStatic = ^TBitStatic;
    TBitStatic = OBJECT(TStatic)
        PROCEDURE Paint(pDC : hDC; VAR PS : TPaintStruct); virtual;
        PROCEDURE WmPaint(VAR Msg : TMessage); virtual
            Wm_First + Wm_Paint;
    END;

    PROCEDURE TBitStatic.Paint(pDC : hDC; VAR PS :
        TPaintStruct);
    VAR
        hb, ob : hBitmap;
        bm : tBitmap;
        bitsDC : hDC;
    BEGIN
        bitsDC := CreateCompatibleDC(pDC);
        hb := LoadBitmap(hInstance, appName);
        GetObject(hb, SizeOf(tBitmap), @bm);
        ob := SelectObject(bitsDC, hb);
        BitBlt(pDC, 0, 0, bm.bmWidth, bm.bmHeight,
            bitsDC, 0, 0, SrcCopy);
        SelectObject(bitsDC, ob);
        DeleteDC(bitsDC);
        DeleteObject(hb);
    END;

    PROCEDURE TBitStatic.WmPaint(VAR Msg : TMessage);
    BEGIN TWindow.WmPaint(Msg); END;

    CONSTRUCTOR TTidyWindow.Init(AParent : PWindowsObject;
        AName : PChar);
    VAR Ps : PStatic;
    BEGIN
        TTidyWindowC.Init(AParent, AName);
        IniName := NIL;
        PS := New(PBitStatic, InitResource(@Self, id_wtBitmap, 0));
    END;

    PROCEDURE TTidyWindow.SetUpWindow;
    VAR
        ArgBuff : ARRAY[0..fsPathName] OF Char;
        DirName : ARRAY[0..fsDirectory] OF Char;
        ProgName : ARRAY[0..fsFileName] OF Char;
        ProgExt : ARRAY[0..fsExtension] OF Char;
    FUNCTION GetFileArg : Boolean;
    VAR ArgC : Word;
    BEGIN
        GetFileArg := FALSE;
        ArgC := GetArgCount;
        IF ArgC > 0 THEN
            BEGIN
                GetArgStr(ArgBuff, 1, fsPathName);
                IF StrLIComp(ArgBuff, '/Q', 2) = 0 THEN
                    BEGIN
                        Quiet := TRUE;
                        IF ArgC > 1 THEN
                            BEGIN
                                GetArgStr(ArgBuff, 2, fsPathName);
                                GetFileArg := TRUE;
                            END;
                        END;
                    END;
                ELSE
                    BEGIN
                        GetFileArg := TRUE;
                        IF ArgC > 1 THEN
                            BEGIN
                                GetArgStr(DirName, 2, fsDirectory);
                                Quiet := StrLIComp(DirName, '/Q', 2) = 0;
                            END;
                        END;
                    END;
                END;
            END;
        END;

        BEGIN
            TTidyWindowC.SetUpWindow;
            IF PMWindow = 0 THEN
                BEGIN
                    MessageBeep(mb_IconStop);
                    MessageBox(hWindow, 'Unable to locate Program Manager',
                        'WINTIDY ERROR', mb_OK + mb_IconStop);
                    CmdShow := sv_Hide;
                    PostQuitMessage(hWindow);
                END;
            ELSE
                BEGIN
                    IF GetFileArg THEN
                        BEGIN
                            FileSplit(ArgBuff, DirName, ProgName, ProgExt);
                            StrCopy(ArgBuff, ProgName);
                            StrCat(ArgBuff, '.INI');

                            StrUpper(ArgBuff);
                            StrCopy(DirName, 'Save/Restore using ');
                            StrCat(DirName, ArgBuff);
                            StrCat(DirName, '?#13'(NO means use WINTIDY.INI));
                            IF NOT Quiet THEN MessageBeep(mb_IconQuestion);
                            IF MessageBox(hWindow, DirName, 'WINTIDY',
                                mb_YesNo + mb_IconQuestion) = idYES THEN
                                BEGIN
                                    IniName := StrNew(ArgBuff);
                                    StrCopy(DirName, 'WINTIDY - ');
                                    StrCat(DirName, ArgBuff);
                                    SetWindowText(hWindow, DirName);
                                END;
                            END;
                            IF IniName = NIL THEN IniName := StrNew('WINTIDY.INI');
                        END;
                    END;
                END;
            END;

            DESTRUCTOR TTidyWindow.Done;
            BEGIN
                StrDispose(IniName);
                TTidyWindowC.Done;
            END;

            FUNCTION TTidyWindow.GetClassName;
            BEGIN
                GetClassName := AppName;
            END;

            PROCEDURE TTidyWindow.GetWindowClass(VAR AWndClass :
                TWndClass);
            BEGIN
                TTidyWindowC.GetWindowClass(AWndClass);
                AWndClass.hIcon := LoadIcon(hInstance, AppName);
            END;

            PROCEDURE TTidyWindow.WmCommand(VAR Msg : TMessage);
            BEGIN
                IF Msg.lParamLo = 0 THEN
                    BEGIN
                        CASE Msg.wParam OF
                            id_ArrIcons : ArrangeAll;
                            id_SaveLay : SaveLayout;
                            id_RestLay : RestoreLayout;
                            id_HowToUse : Application.ExecDialog(New(PDialog,
                                Init(@Self, 'TidyHelp')));
                            id_AboutIt : Application.ExecDialog(New(PDialog,
                                Init(@Self, 'TidyAbout')));
                        ELSE TTidyWindowC.WmCommand(Msg);
                        END;
                    END;
                ELSE TTidyWindowC.WmCommand(Msg);
                END;

            PROCEDURE TMyApplication.InitMainWindow;
            BEGIN
                MainWindow := New(PTidyWindow, Init(NIL, AppName));
            END;

            VAR MyApp : TMyApplication;
            BEGIN
                MyApp.Init(AppName);
                MyApp.Run;
                MyApp.Done;
            END.

```

Figure 8: The TTidyWindow object inherits all the abilities of its ancestors and supplies them with a user interface.

WriteOneLocation subprocedure discussed in Step Two, above. It reads the window placement data from the .INI file, converts that data into a TWindowPlacement structure, and calls SetWindowPlacement to restore the window. LocateFromINI will be called again, at the end of the restoration process, to restore the group windows.

RestoreLayout now hides the Program Manager so the process of restoring

the layout won't be slowed by displaying every step on the screen. Using the technique introduced in the GroupVU and GroupMenu programs associated with this issue's Lab Notes, RestoreLayout processes all active .GRP files. That is, for each possible key, from Group1 to Group40, it attempts to extract a corresponding .GRP filename from PROGRAM.MAN.INI. When it makes a hit, it initializes a TGroupFilW object using that

filename. Again, this object inherits the ability to read and interpret .GRP files. It can also write a limited amount of data to the .GRP file.

For each item listed in the .GRP file, RestoreLayout calls the UpdateItem subfunction. This function attempts to retrieve a stored position for the item from the .INI file. If a stored position is available, UpdateItem compares it with the current position of the item, returning

TRUE only if the current position is *different*. In that case, RestoreLayout calls on the TGroupFilW object to write the updated information back to the .GRP file. When all items have been checked, UpdateItem calls the TGroupFilW object's Destructor, which updates the .GRP file's checksum (if necessary) and then closes the file.

As mentioned earlier, updating the .GRP files is a necessary but not a sufficient condition for setting the item positions, since ProgMan still has to be informed of the change. Thus, the last line of RestoreLayout calls the inherited InitDDEConversation method, in preparation for sending ProgMan a command to reload the .GRP files.

TTidyWindowC must be able to have its own DDE conversation with ProgMan or must allow the TTidyWindowB conversation to occur. Its wmDDEAck and Converse methods use the Reloading data field to determine which conversation is taking place. If Reloading is TRUE, the Converse method sends a wm_DDE_Execute message to ProgMan, passing the command [Reload], which tells ProgMan to reload all groups. Note that adding a group name to the command—[Reload(Main)], for example—would tell ProgMan to reload only the specified group.

ProgMan should process this command and send a positive acknowledgment via the wm_DDE_Ack message. The wmDDEAck method of TTidyWindowC responds by terminating the conversation and calling the RestoreGroupWindows method.

So far the restoration process has restored the window placement of ProgMan itself and the location of the items within each group. The method RestoreGroupWindows restores the placement of each group window. As before, it calls GetGroupHandles to get a list of group window handles in the THA array. For each of these handles RestoreGroupWindows then calls the LocateFromINI method, which attempts to read a window placement line from the .INI file and to place the window accordingly. If there is no entry for the group in the .INI file, LocateFromINI informs the user that this group has been added since the last Save Layout. After restoring all group windows, RestoreGroupWindows unhides

ProgMan and lets the user know that the restoration is complete.

THE PAYOFF: WINTIDY Since the TTidyWindowC object inherits the functionality of its ancestors, it is actually capable of performing all three of WINTIDY's tasks. All that is needed now is a user interface. This is provided by the main TTidyWindow object, which is defined as a descendant of TTidyWindowC. The main program file WINTIDY.PAS appears in Figure 8.

TTidyWindow's SetupWindow method handles command line processing. Treating the first command line argument as a filename, it calls the FileSplit function from the WinDOS unit to separate the line into path, name, and extension. Of these, SetupWindow keeps only the name, appends the .INI extension, and converts the result to uppercase. If the user confirms that this is indeed the desired .INI filename, the SetupWindow method initializes the object's IniName field with the specified name. If the user answers No, or if no .INI name was specified, SetupWindow initializes IniName with the string WINTIDY.INI.

The wmCommand method responds to all commands from the menu. The three choices from the Action menu each call the appropriate method from one of TTidyWindow's ancestors. Each of the Help menu items calls up a dialog box defined in the program's resource file. One is the typical About box, which displays the copyright information; the other briefly explains how to use the program.

I made WINTIDY's main window a dialog box because I wanted to keep its size small, not because it actually needed to use dialog controls. Just for fun, however, I used icons to draw a little picture in the box of a broom sweeping away a messy ProgMan window icon. The program's default icon is also a broom.

When I first considered enhancing the original WINTIDY to save and restore the placement of group windows and icons, I had no idea what a long, strange trip lay ahead of me. The end result looks deceptively simple to the user, but under the hood, you'll find a wide variety of programming techniques. □

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Exploring the FONTMETRICS Structure, Part 2

BY CHARLES PETZOLD

Perhaps the most important lesson to learn when programming for graphical environments is this: Never trust the technical reference manuals. They've gotten better over the years, but they haven't quite reached an acceptable level. Sometimes the documentation is wrong, sometimes it's missing, and sometimes it describes something that simply has not been implemented.

Of course, it would be best to program based on documentation rather than the idiosyncracies of implementation. But that doesn't seem to be possible. It's usually essential to study what the system actually does. That's why I began my exploration into using fonts under the OS/2 2.0 Presentation Manager with a program that called GpiQueryFonts to enumerate all the fonts on the system. This program—named FONTLIST—appeared in the December 8, 1992, column.

GpiQueryFonts returns information about the available fonts as an array of FONTMETRICS structures. Figure 1 shows the FONTMETRICS structure as it's defined in the OS2DEF.H header file. I've inserted some blank lines to separate the fields of the structure into related groups. In the last issue I discussed the first three groups of fields, ending with lMaxBaselineExt.

SLOPE, DIRECTION, AND ROTATION We'll begin with the three fields in the FONTMETRICS structure called sCharSlope, sInlineDir, and sCharRot. These are 16-bit values expressed as angles in degrees and minutes. The low 9 bits store the degrees (from 0 through 359), the next higher 6 bits are the minutes (0 through 59), and the high bit is 0. In the FONTLIST program, these values are displayed as four-digit hexadecimal numbers.

The sCharSlope value is defined in the

IBM documentation as the angular slope of the characters measured clockwise from the vertical. This angle will be positive for italic or oblique fonts. For example, the OS/2 Courier Italic and Helvetica Italic outline fonts have a 12-degree (0x000C) character slope, and the Times New Roman Italic font has a 16-degree (0x0010) character slope.

Unfortunately, the sCharSlope field doesn't seem to be quite as meaningful for fonts on my PostScript printer. In this case, GpiQueryFonts reports that the

Technical documentation is rarely perfect, so this discussion of the remaining fields of the FONTMETRICS structure includes a look at what is wrong, missing, or just not implemented.

Courier Oblique and Helvetica Oblique fonts have a character slope of 0xFF88, and the Times Italic font has a character slope of 0xFF65.

In general, then, don't rely on sCharSlope to give you a meaningful value. You can test for a nonzero value to determine if the font is oblique or italic but there's another method using the fsSelection field that I'll discuss shortly.

The sInlineDir value is defined in the IBM documentation as the "direction in which the characters in the font are designed for viewing, in degrees increasing clockwise from the horizontal." I've never encountered a font where this field is nonzero.

The sCharRot value is defined as the

"rotation of the character glyphs with respect to the baseline, the angle increasing counterclockwise." Again, every font I've ever encountered has had an sCharRot field of zero.

While exploring these three fields, I thought that the landscape fonts available in some LaserJet cartridges might show sInlineDir or sCharRot values of nonzero. But these fonts don't even show up when you call GpiQueryFonts unless you set the page orientation to landscape, and in that case the portrait fonts don't show up.

The FONTMETRICS structure is also used with the GpiQueryFontMetrics function to determine the characteristics of the current font selected in a presentation space. For outline fonts, the font size information in the structure is affected by calls to GpiSetCharBox. I thought that these three fields might be affected by calls to GpiSetCharShear or GpiSetCharAngle. They are not.

Conclusion: The only meaningful information in these three fields is that sCharSlope indicates an italic or oblique font, and this particular information is available elsewhere in the FONTMETRICS structure.

WEIGHT AND WIDTH The next two fields are named sWeightClass and sWidthClass. These fields tell us a little about the weight and width of the characters in a font. The weight of a font refers to the thickness of the strokes that make up the characters. From our experience with bitmap fonts, we're accustomed to thinking of fonts as being simply normal or bold. But in real typography there can be far more variation. For example, Helvetica fonts can exist in such permutations as Helvetica Ultra Light, Helvetica Thin, Helvetica Light, Helvetica Medium, Helvetica Bold, Helvetica Heavy, and Helvetica Black. Some fonts use the word Demi or Demibold for fonts that are heavier

The FONTMETRICS Structure

```
typedef struct _FONTMETRICS
{
    CHAR    szFamilyname [FACESIZE] ;
    CHAR    szFacename [FACESIZE] ;

    USHORT  idRegistry ;
    USHORT  usCodePage ;

    LONG    lEmHeight ;
    LONG    lXHeight ;
    LONG    lMaxAscender ;
    LONG    lMaxDescender ;
    LONG    lLowerCaseAscent ;
    LONG    lLowerCaseDescent ;
    LONG    lInternalLeading ;
    LONG    lExternalLeading ;
    LONG    lAveCharWidth ;
    LONG    lMaxCharInc ;
    LONG    lEmInc ;
    LONG    lMaxBaselineExt ;

    SHORT    sCharSlope ;
    SHORT    sInlineDir ;
    SHORT    sCharRot ;

    USHORT    usWeightClass ;
    USHORT    usWidthClass ;

    SHORT    sXDeviceRes ;
    SHORT    sYDeviceRes ;

    SHORT    sFirstChar ;
    SHORT    sLastChar ;
    SHORT    sDefaultChar ;
    SHORT    sBreakChar ;

    SHORT    sNominalPointSize ;
    SHORT    sMinimumPointSize ;
    SHORT    sMaximumPointSize ;

    USHORT    fsType ;
    USHORT    fsDefn ;
    USHORT    fsSelection ;
    USHORT    fsCapabilities ;

    LONG    lSubscriptXSize ;
    LONG    lSubscriptYSize ;
    LONG    lSubscriptXOffset ;
    LONG    lSubscriptYOffset ;
    LONG    lSuperscriptXSize ;
    LONG    lSuperscriptYSize ;
    LONG    lSuperscriptXOffset ;
    LONG    lSuperscriptYOffset ;
    LONG    lUnderscoreSize ;
    LONG    lUnderscorePosition ;
    LONG    lStrikeoutSize ;
    LONG    lStrikeoutPosition ;

    SHORT    sKerningPairs ;
    SHORT    sFamilyClass ;

    LONG    lMatch ;

    LONG    FamilyNameAtom ;
    LONG    FaceNameAtom ;

    PANOSE  panose ;
}
FONTMETRICS ;
```

Figure 1: The FONTMETRICS structure as defined in OS2DEF.H. It's used to obtain the characteristics of available fonts.

than Medium but not quite as bold as Bold.

The usWeightClass field is intended to convert these words into numbers. As documented, the usWeightClass numbers can range from 1000 to 9000. But in reality they range from 1 to 9, corresponding to Ultra Light, Extra Light, Light, Semi Light, Medium, Semi Bold, Bold, Extra Bold, and Ultra Bold. These aren't exactly the same words used for

the Helvetica typeface names, but I'm sure you get the general idea. For the Adobe Type 1 fonts on my system, I've seen usWeightClass values ranging from 3 (Light) through 7 (Bold).

Fonts in the same family can also vary by character width. Helvetica is again a good example. You can find face names such as Helvetica Compressed, Helvetica Extra Compressed, Helvetica Ultra Compressed, Helvetica Condensed, and Helvetica Extended. Some font names include the word Expanded rather than Extended, or Narrow rather than Compressed or Condensed. (By the way, if you want to see what all these Helvetica fonts look like, pick up *The Electronic Type Catalog* by Steve Byers, published by Bantam Books.)

The usWidthClass field converts the font-width adjectives to numbers, again documented as ranging from 1000 to 9000 but actually ranging from 1 through 9, corresponding to Ultra Condensed, Extra Condensed, Condensed, Semi Condensed, Medium, Semi Expanded, Expanded, Extra Expanded, and Ultra Expanded.

Although these two values are useful for numerically categorizing the font, they don't provide information as extensive as the PANOSE structure, which is the last field of the FONTMETRICS structure. (Actually I should say the information *supposedly* provided in the PANOSE structure, as we'll see.)

DEVICE RESOLUTION The two fields called sXDeviceRes and sYDeviceRes are very important for bitmap fonts because they indicate the device resolution (in pixels per inch) for which the font was designed.

If you use GpiQueryFonts to enumerate fonts, you will probably want to prepare by calling DevQueryCaps with the CAPS_HORIZONTAL_FONT_RES and CAPS_VERTICAL_FONT_RES constants. The two values you'll obtain from DevQueryCaps provide the ideal resolution of the device in pixels per inch. For the VGA, these two values are 96 dots per inch, and for the 8514/A (which has a display size of 1,024 by 768 pixels), the font resolution values are 120 dots per inch.

GpiQueryFonts may return information about bitmap fonts that are designed for video displays other than the one

you're running. For bitmap fonts returned from GpiQueryFonts, simply compare the two values returned from DevQueryCaps with the sXDeviceRes and sYDeviceRes fields. Ignore any bitmap fonts that don't match.

For outline fonts, these two fields are always set to 1000. But just for fun, let's look at the IBM on-line documentation for sXDeviceRes: "For outline fonts this is the number of notional units in the X direction of the Em square, measured in notional units per Em. (Notional units are the units in which the outline is defined.)" Surely you understand now why the values are 1000!

Actually there's a much simpler explanation, and I think it's in accordance with the intent of the documentation writer: Designs of Adobe Type 1 outline fonts are always based on a font size of 1,000 points.

Don't use this field for determining whether a font is a bitmap font or an outline font. Use the usDefn field (described below) instead.

THE FONT CHARACTER CODES Next in the FONTMETRICS structure are four fields that describe the range of character codes in the font. This may be a little puzzling because we're accustomed to thinking of 1-byte character codes, which range from 0 to 255. But OS/2 fonts generally contain more than 256 characters in order to accommodate various codepages. The original IBM character set is one codepage (number 437), but a multilingual codepage (number 850) is also supported as are several others. These codepages have additional accented characters used in many European languages. The fonts must accommodate all the characters in all the codepages.

In all the fonts I've seen, sFirstChar is 1 because there is no character defined for code point 0. The sLastChar value depends on the font. It's 382 for bitmap fonts and disk-based Adobe Type 1 fonts, 332 for the fonts on my PostScript printer, and 255 for symbol or dingbat fonts.

The sDefaultChar and sBreakChar values are always 31, which is an offset from sFirstChar, so they represent code point 32, which is the space character.

Curiously enough, if you use GpiSetCp to define an EBCDIC codepage (for which the space character is not code point 32) and then call GpiQueryFont-

Metrics, you'll still find that `sDefaultChar` and `sBreakChar` are set to 31. So in the one case where these values would be helpful, they are not.

THE POINT SIZES The next three fields are named `sNominalPointSize`, `sMinimumPointSize`, and `sMaximumPointSize`, and they contain point sizes of the font in decipoints (that is, tenths of a point or $\frac{1}{720}$ of an inch).

For bitmap fonts, the `sNominalPointSize` is very important. As I mentioned last issue, it's not always possible to calculate an accurate font point size from the earlier font metrics fields. This field gives you that information. For the standard bitmap fonts, you'll find `sNominalPointSize` values of 80, 100, 120, 140, 180, and 240, which are 10 times the point sizes.

For bitmap fonts, the `sMinimumPointSize` value is half the `sNominalPointSize` value, and `sMaximumPointSize` is double it. But because GDI does not even attempt to compress or expand bitmap fonts, these two values are meaningless and the PM reference acknowledges that.

Outline fonts are scalable, so all these values are pretty much meaningless as well. For the outline fonts I've seen, `sNominalPointSize` is either 100 or 120, `sMinimumPointSize` is 10 (1 point), and `sMaximumPointSize` is either 7200 (720 points) or 10000 (1000 points). The IBM documentation says that these values are not restrictions on the size that the font can be scaled.

FOUR FIELDS OF BIT CODES The next four fields are composed of bit codes that describe various aspects of the font. The FONTLIST program displays these values in hexadecimal.

The OS2DEF.H header file defines nine constants beginning with the prefix `FM_TYPE` that you can use for testing the bits of the `fsType` field. However, I've only seen two bits of this field set to 1. You can test the lowest bit with the constant `FM_TYPE_FIXED` to determine if the font is of fixed pitch. The second lowest bit (which can be tested with `FM_TYPE_LICENSED`) indicates a licensed font.

The `fsDefn` field is probably the most important of these four fields. The lowest bit (which you can test using the constant `FM_DEFN_OUTLINE`) is 1 for outline

fonts and 0 for bitmap fonts. Use this bit if you want to restrict your program to either bitmap or outline fonts.

The highest bit of `fsDefn` (which you can test using `FM_DEFN_GENERIC`) is 1 for GPI fonts and 0 for device fonts. For printers, device fonts are those stored in the printer's ROM or a font cartridge, or fonts that can be downloaded to the printer but not used anywhere else. For video displays, device fonts are the System Proportional and System Monospaced fonts. The bitmap fonts and Adobe Type 1 fonts are all GPI fonts.

The OS2DEF.H header file defines six constants beginning with the prefix `FM_SEL` that you can use to test the bits of the `fsSelection` field. These indicate whether the font is italic or bold, or has an underline or strikeout. The IBM online documentation indicates that "the flags do not reflect simulations applied to the physical font." For bitmap fonts, italics and bold are simulated; for all fonts, underline and strikeout are simulated.

I've never seen a font that has any `fsSelection` bits set other than the lowest, which you can test using `FM_SEL_ITALIC`. However, this bit is not set for oblique fonts on my PostScript printer. Presumably, GPI scans the font face name for the word *italic* to determine whether to set this bit.

I've never seen a font that has a non-zero `fsCapabilities` field. The low bit is supposed to indicate that the font cannot be mixed with graphics. The high byte is defined as possibly representing the quality of the font.

SUBSCRIPTS AND SUPERSCRIPTS And now we come to eight fields that are potentially very important if you want to write an application that implements subscripts and superscripts in a manner appropriate for the particular font. These fields tell you how to size the subscripts and superscripts and where to place them relative to the normal text. At least that's the premise. The reality, unfortunately, doesn't quite measure up.

In theory, subscripts should be a little smaller than the text in which they appear. The `lSubscriptXSize` and `lSubscriptYSize` fields of the structure are supposed to give you that information. But if you're dealing with bitmap fonts, you must select a font based on exact `lMaxBaselineExt` and `lAveCharWidth`

values. You'd have to search through the available bitmap fonts to find the closest match of the font height.

For outline fonts we have a better chance of making it work. Let's take a look at IBM's on-line documentation for a few hints. The `lSubscriptYSize` is defined as "The recommended vertical size for subscripts for this font in world coordinate units." But what vertical size? As we discovered in the last issue, there are several fields in FONTMETRICS that indicate font height. The two most important are `lEmHeight`, which is the point size of the font in world coordinates, and `lMaxBaselineExt`, which is the maximum height of characters and a good value for the line spacing.

It must be the point size, because this is how outline fonts are scaled. As we'll see in a future issue, outline fonts are scaled by the `GpiSetCharBox` function, in which the vertical and horizontal size of the font is specified by the em square, which is the point size in world coordinates. After you call `GpiSetCharBox` to scale a font, you can call `GpiQueryFontMetrics` to obtain the FONTMETRICS information of that font.

To create a subscript, you'd pass the `lSubscriptXSize` and `lSubscriptYSize` fields to `GpiSetCharBox`, move the baseline down, display the subscripted text, move the baseline back up, restore the original character box size, and continue.

For all the Adobe Type 1 fonts I've seen, `lSubscriptYSize` is 65 percent of the `lEmHeight` field, and `lSubscriptXSize` is 60 percent of the `lEmInc` field. The `lSuperscriptYSize` and `lSuperscriptXSize` values are the same as the subscript sizes. (If world coordinates represent the same physical dimensions in the horizontal and vertical directions, then `lEmHeight` and `lEmInc` are equal.

The `lSubscriptXOffset` and `lSubscriptYOffset` values tell you how to move the current position before displaying the subscripted text. The `lSubscriptYOffset` field represents a distance below the baseline. Similarly, `lSuperscriptXOffset` and `lSuperscriptYOffset` values are for moving the current position before displaying superscripted text, where `lSuperscriptYOffset` is a distance above the baseline.

The `lSubscriptXOffset` and `lSuperscriptXOffset` values are 0 in all the fonts

I've seen. This makes sense, because there shouldn't be any extra horizontal space before the subscript or superscript. But although the `lSuperscriptYOffset` fields are between 20 percent and 30 percent of the point size, the `lSubscriptYOffset` field is set to 0 in all Adobe Type 1 outline fonts I've seen.

Obviously, this is not correct. The baseline of the subscripted text should be lower than the normal text. So essentially, you're on your own figuring out how to position subscripts.

Reality gets worse: For all the fonts on my PostScript printer, all eight of these fields are set to zero.

UNDERScores AND STRIKEOUTS When you request a font using `GpiCreateLogFont`, you can specify whether you want the font with underscores or strikeouts. If you'd rather implement these yourself, you can use the next four fields. The `lUnderscorePosition` field provides the distance below the baseline that the underscore is to appear, and `lUnderscoreSize` is the width of the underscore line. Both values are in world coordinates.

Similarly, `lStrikeoutPosition` is the distance of the strikeout line above the baseline, and `lStrikeoutSize` is the width of the strikeout line.

Why would you want to draw your own strikeout lines and underscores when GPI does it for you? Well, suppose you want to draw the strikeout line in red against a black font; the information is available to do this. Or if you want a double underscore, the two fields provide enough information to implement it intelligently in a manner consistent with the single underscore.

THE REMAINING FIELDS We're almost finished here. The `sKerningPairs` field is the number of kerning pairs. Kerning is the practice of placing two letters closer together than they would normally appear. For example, when the two letters W and e are displayed together, the e should be somewhat under the right arm of the W. Thus, We is a kerning pair. This is implemented for all the Adobe Type 1 outline fonts. But some fonts, such as Courier and Symbol, don't have any kerning pairs.

An average Adobe Type 1 font has about 100 kerning pairs. (However, I've never seen the `FM_TYPE_KERNING`

flag bit of the `fsType` field set. This is supposed to indicate that the font has kerning information.) Once you know how many kerning pairs there are, you can allocate memory for an array of `KERNINGPAIRS` structures and call `GpiQueryKerningPairs`. If you'd rather GPI handle kerning for you, you can specify that when you call `GpiCreateLogFont`.

The `sFamilyClass` is defined in the IBM on-line documentation with the sentence "This value contains a font class and its subclass." That's all it says. Very informative.

The `lMatch` field tells us nothing about the font, but it's a number that uniquely identifies the font in the device context. You can use this number when you set up the `FATTRS` (font attributes) structure in preparation for calling `GpiCreateLogFont`. We'll see how to do this in the next issue.

The last three fields are new in OS/2 2.0, and they have not been implemented yet. (I'm told that they will be implemented in the forthcoming 32-bit version of the OS/2 graphics engine.)

As you'll recall, the `szFamilyname` and `szFacename` fields of the structure are large enough for only 31 characters. Some font face names are longer than that. For example, my PostScript printer has fonts called ITC Avant Garde Gothic Book Oblique and New Century Schoolbook Bold Italic, both of which are a few characters too long. If this is the case, then the `FamilyNameAtom` or `FaceNameAtom` fields are supposed to contain system atoms for the family name or face name strings. Atoms are numbers that refer to strings stored in a table. To use this information, you call `WinQuerySystemAtomTable` to obtain a handle to the system atom table, and `WinQueryAtomName` to obtain the string associated with the atom.

Currently, however, these fields often seem to contain random numbers. I'd avoid dealing with these fields for a while. At any rate, you should use the `FM_TYPE_FACETRUNC` and `FM_TYPE_FAMTRUNC` constants with the `fsType` field to first determine if the names have been truncated.

Finally we come to the `PANOSE` field. This field is of type `PANOSE`, which is another structure as shown in Figure 2. `PANOSE` is described in A

The PANOSE Structure

```
typedef struct _PANOSE
{
    BYTE    bFamilyType ;
    BYTE    bSerifStyle ;
    BYTE    bWeight ;
    BYTE    bProportion ;
    BYTE    bContrast ;
    BYTE    bStrokeVariation ;
    BYTE    bArmStyle ;
    BYTE    bLetterform ;
    BYTE    bMidline ;
    BYTE    bXHeight ;
    BYTE    abReserved [2] ;
}
PANOSE ;
```

Figure 2: The PANOSE system attempts to classify fonts using a series of numbers based on certain font characteristics, but the PANOSE structure (the last field of the `FONTMETRICS` structure) is not yet implemented in OS/2 2.0.

Manual of Comparative Typography: The PANOSE System by Benjamin Bauermeister (Van Nostrand Reinhold, 1988). PANOSE attempts to classify fonts using a series of numbers based on certain font characteristics, such as the style of serifs, weight, proportion, x-height, and so on. The word PANOSE is composed of letters that are helpful in categorizing the font.

While the PANOSE system seems to lose sight of the font forest by focusing on tiny properties of the characters, it does have the potential for giving programs the ability to select fonts based on their actual appearance rather than some obscure face name. Indeed, the TrueType fonts of Windows 3.0 contain PANOSE information, and Windows NT allows selecting fonts based on a desired PANOSE code.

But the PANOSE structure is not yet implemented in OS/2 2.0. In some cases, the fields of the structure all get set to 0, which would be satisfactory because 0 values essentially mean "don't know." But sometimes the PANOSE fields seem to be filled with random numbers, some of which are out of bounds and this could be dangerous for a program unwarily attempting to use PANOSE information.

COMING UP Now that we know how to query the available fonts and get some information about them (and ignore the bogus information!), we're ready to start selecting fonts and doing something with them. Stay tuned. □

A Look at the Windows System Registry

BY RAY DUNCAN

T

he Windows system registry, which made its first appearance in Version 3.1, is essentially a hierarchical database that is kept in memory while Windows is running. The Windows 3.1 registry is structured as a single binary tree, and each leaf of the tree is a name associated with a value—conceptually very similar to an environment variable. The location of a given leaf of the tree is expressed as a series of subkeys separated by backslashes, in the same manner as the pathname of a file, and the fully qualified key for a value (that is, the explicit series of keys from the root of the tree) is guaranteed to be unique within the registry.

The information stored in the system registry by Windows 3.1 is neither extensive nor impressive. It consists only of the file associations known to the File Manager and of the information needed by clients to find servers for Object Linking and Embedding (OLE). Windows application programs can gain access to the registry via a small set of API functions, using a predefined handle (HKEY_CLASSES_ROOT) for the key at the tree's root. Adventurous end users can inspect or change the registry directly with a utility called REGEDIT.EXE, although this is a somewhat perilous process, and registry manipulation is more typically carried out invisibly and automatically by installation programs.

In Windows NT the system registry plays a much more important role. All of the system configuration information (which Windows 3.x maintains in plain text .INI files such as WIN.INI and SYSTEM.INI) is deposited by NT in the registry. NT also uses the registry to store access control lists, extensive hardware-related information, per-user desktop setups, and even program manager

groups. This data is organized as at least five binary trees, with a correspondingly more complex API for application programs and an enhanced REGEDIT for end users. It may give you some idea of the size and complexity of the NT system registry when I tell you that if you print REGEDIT's listings of the registry to a disk file, the file occupies nearly a megabyte.

USING THE NT REGISTRY API Something as big as NT's system registry must be pretty important, but getting a grasp of

Two programs illustrate how to access and display the extensive information on system configuration, resources, and performance that Windows NT maintains in its system registry.

how it works and what it's good for is not a project you can knock off in a single day. Looking at the rather sparse registry documentation in the July 1992 NT PDK, I'm strongly reminded of the situation programmers faced when Extended Attributes (EAs) were introduced in OS/2's High Performance File System (HPFS). The API functions for EAs were cryptic and complex, the few example programs overly elaborate, and Microsoft/IBM offered virtually no guidance on the conceptual framework behind the EAs or the long-term plans for their use. The system registry is far more vital to NT than EAs ever were to OS/2, but the chapter on the registry in the *Programmer's Overview* manual is blank except for a title page

that says the material will be supplied later!

Luckily, John Hall, an engineer at Microsoft, recently posted a couple of very compact, neatly written demonstration programs for the system registry on CompuServe. Putting these programs together with the function call documentation and the tree listings obtained from REGEDIT, we can get a pretty clear picture of how to use—and how not to abuse—the NT system registry. One of the more interesting discoveries about the registry is that it contains extensive system resource allocation and performance information that is apparently updated in real time. It appears, in fact, that the PERFMON.EXE utility shipped in the July 1992 PDK obtains all of the data that it displays from the system registry.

The Win32 API functions related to the system registry are summarized in Figure 1. In order to extract a specific value from the registry, you must have in hand a handle for a particular node in one of the registry's binary trees, a string that defines the path of keys from that node to the leaf holding the value of interest, and the name of the value. There are five predefined documented (or semi-documented) handles for the roots of the registry's trees that you can use without further ado:

```
HKEY_CLASSES_ROOT
HKEY_CURRENT_USER
HKEY_LOCAL_MACHINE
HKEY_USERS
HKEY_PERFORMANCE_DATA
```

The first step is to call RegOpenKey() or RegOpenKeyEx() with the key handle, the path string, the address of a variable to receive a new key handle, and (in the case of RegOpenKeyEx) a flag that describes the type of access you are requesting. (If you know the full path of

keys to the value of interest, you can get a handle that brings you directly to the desired "leaf" in one operation; otherwise you'll have to walk through the tree one node at a time.)

Next, you call `RegQueryInfoKey()` to determine how much memory you'll need for the data you'll receive from the registry. `RegQueryInfoKey()` returns—among other things—the size of the largest data value in the subtree beneath the node that corresponds to the supplied handle, so it allows you to plan for the worst case.

Then you use `malloc()`, `GlobalAlloc()`, or `VirtualAlloc()` to allocate a buffer for the registry data. Now you're ready to obtain the actual data with a call to `RegQueryValue()` or `RegQueryValueEx()`. Finally, the key handle that you obtained from `RegOpenKey()` or `RegOpenKeyEx()` should be released by calling `RegCloseKey()`.

To make the process more concrete, let's consider the system registry node

```
HARDWARE\DESCRIPTION\SYSTEM
\CENTRALPROCESSOR\0
```

which is found in the tree whose root has the predefined handle `HKEY_LOCAL_MACHINE`. This node has three leaves that describe the central processor in a single-processor system or the first processor of a multiprocessor system. The leaf named Component Information has 16 bytes of binary information whose significance is unknown; the leaf named Identifier contains the CPU model and step level as a text string; and the leaf named Configuration Data has 16 bytes of binary information whose interpretation is, again, unknown.

The short program `CPUTYPE.C`, whose source listing can be found in Figure 2, illustrates how to fetch the string that corresponds to

```
\HKEY_LOCAL_MACHINE\HARDWARE
\DESCRIPTION\CENTRALPROCESSOR
\0\IDENTIFIER
```

and how to display it. When I run `CPUTYPE` on my machine, it displays:

```
The CPU type is: Intel-80386-d1
```

The `CPUTYPE` code that accesses the

registry is encapsulated in the routine `GetSZKeyData()`. You can lift this procedure out as a black box and incorporate it into your own programs. `GetSZKeyData()` is specialized for the retrieval of null-terminated strings, but you can easily modify it for other types of registry data or generalize it to return any type at all. You'll notice that, even though all strings are stored in the NT system registry in UNICODE, we are studiously ignoring UNICODE versus ANSI character set issues in `CPUTYPE`. We can get away with this because, in nearly all cases, NT/Win32 automatically translates UNICODE into ASCIIZ (actually, null-terminated ANSI) strings for application programs that don't specifically enable UNICODE support.

SYSTEM REGISTRY PERFORMANCE DATA
Although the performance data in the system registry is surprisingly extensive, it isn't mentioned anywhere in the NT

PDK manuals. When I tried out the utility `PERFMON.EXE`, I jumped to the conclusion that it was using undocumented APIs like several of the other NT PDK utilities; I probably wouldn't have stumbled on the system registry angle for years if not for one of John Hall's demo programs. It turns out that the registry performance data is documented quite clearly, if discreetly, in the `WINPERF.H` header file that is found in the NT tools directory along with `WINDOWS.H` and related header files.

The performance information is retrieved from the registry by calling `RegQueryValueEx` with the predefined key `HKEY_PERFORMANCE_DATA` and the value name `Global`. The block of data that comes back, which can be quite large even on a lightly loaded system (some 16K on my system with only the Program Manager and one other application running), has an elaborate internal structure.

Win32 System Registry Functions

Function	Description
<code>RegCloseKey()</code>	Closes handle for a registry key.
<code>RegConnectRegistry()</code>	Provides access to a system registry on another machine.
<code>RegCreateKey()</code>	Adds a key to the system registry or opens the key if it already exists.
<code>RegCreateKeyEx()</code>	Like <code>RegCreateKey()</code> but with security options.
<code>RegDeleteKey()</code>	Removes a key from the system registry.
<code>RegDeleteValue()</code>	Removes a value from the system registry.
<code>RegEnumKey()</code>	Enumerates the subkeys of the specified key.
<code>RegEnumKeyEx()</code>	Like <code>RegEnumKey()</code> but with class and time/date-last-written information.
<code>RegEnumValue()</code>	Enumerates the values of the specified key.
<code>RegFlushKey()</code>	Writes all attributes of an open key to the system registry.
<code>RegGetKeySecurity()</code>	Retrieves a copy of the security descriptor for a previously opened key.
<code>RegLoadKey()</code>	Replaces one key subtree with another subtree that is read from a file.
<code>RegNotifyChangeKeyValue()</code>	Requests that the handle for the specified event object be signaled when the key or its subtree has changed.
<code>RegOpenKey()</code>	Returns a handle for the specified key.
<code>RegOpenKeyEx()</code>	Like <code>RegOpenKey()</code> but with ability to specify access rights.
<code>RegQueryInfoKey()</code>	Returns size information for a key's value, along with last write date/time, the key's class, and other information.
<code>RegQueryValue()</code>	Returns a key's value data.
<code>RegQueryValueEx()</code>	Like <code>RegQueryValue()</code> but also returns data type.
<code>RegReplaceKey()</code>	Replaces one subtree with another in the registry's disk file; the changes are effective the next time the system is started.
<code>RegRestoreKey()</code>	Replaces the specified subtree with a new subtree read from a file. Apparently different from <code>RegLoadKey()</code> although the difference is not clearly explained in the NT PDK manual.
<code>RegSaveKey()</code>	Writes the specified key subtree into a file.
<code>RegSetKeySecurity()</code>	Changes the security descriptor for a previously opened key.
<code>RegSetValue()</code>	Changes the value associated with the specified key. Can only be used for values that are null-terminated strings.
<code>RegSetValueEx()</code>	Like <code>RegSetValue()</code> but allows setting of other data types.
<code>RegUnLoadKey()</code>	Unloads a key and its subtree. Intent unclear from PDK manual.

Figure 1: These are the API functions for accessing the Windows NT system registry.

CPUTYPE.C

Complete Listing

```
// CpuType - System Registry Demo
// Retrieves and Displays CPU Type of Host Machine
// Copyright (C) 1992 Ray Duncan
// PC Magazine * Ziff Davis Publishing

#include <stdlib.h>
#include <stdio.h>
#include <windows.h>

//
// GetSZKeyData() -- given a currently open registry key, the name
// of a subkey, and a value name, returns a pointer to the ASCIIZ data
// associated with that value name. If any necessary function fails
// or the data is not ASCIIZ, returns NULL.
//
LPSTR GetSZKeyData(HKEY hKey, LPSTR szSubKeyName, LPSTR szValueName)
{
    HKEY hNewKey;
    char chClass[10];
    DWORD dwType;
    DWORD cSubKeys;
    DWORD cbMaxSubkey;
    DWORD cbMaxClass;
    DWORD cValues;
    DWORD cbMaxValueName;
    DWORD cbMaxValueData;
    DWORD cbSecurityDescriptor;
    DWORD cbClassSize = 10; // sizeof(chClass);
    LPSTR pKeyValue;
    FILETIME ftLastWriteTime;

    // open the specified subkey
    if(ERROR_SUCCESS !=
        RegOpenKeyEx(hKey, szSubKeyName, 0, KEY_QUERY_VALUE, &hNewKey))
        return(NULL);

    // retrieve size of largest data field for this subkey
    if(ERROR_SUCCESS !=
        RegQueryInfoKey(hNewKey, chClass, &cbClassSize, NULL,
            &cSubKeys, &cbMaxSubkey, &cbMaxClass, &cValues, &cbMaxValueName,
            &cbMaxValueData, &cbSecurityDescriptor, &ftLastWriteTime))
    {
        RegCloseKey(hNewKey);
        return(NULL);
    }

    cbMaxValueData++;

    // allocate memory to hold the incoming data
```

```
pKeyValue = malloc(cbMaxValueData * sizeof(TCHAR));

if(pKeyValue == NULL)
{
    RegCloseKey(hNewKey);
    return(NULL);
}

// retrieve data for specified key, subkey, and valuenam
if(ERROR_SUCCESS !=
    RegQueryValueEx(hNewKey, szValueName, NULL, &dwType,
        (LPBYTE) pKeyValue, &cbMaxValueData))
{
    free(pKeyValue);
    RegCloseKey(hNewKey);
    return(NULL);
}

// if data is not ASCIIZ, return error
if(dwType != REG_SZ)
{
    free(pKeyValue);
    RegCloseKey(hNewKey);
    return(NULL);
}

// release the subkey
RegCloseKey(hNewKey);

// return pointer to the ASCIIZ key value
return(pKeyValue);
}

// this simple demonstration of use of the registry
// just retrieves and displays the CPU type.
VOID main(VOID)
{
    LPSTR pKeyValue;

    pKeyValue = GetSZKeyData(HKEY_LOCAL_MACHINE,
        "Hardware\\Description\\System\\CentralProcessor\\0",
        "Identifier");

    if(pKeyValue)
        printf("The CPU type is: %s.\n", pKeyValue);
    else
        printf("CPU type not found in registry.\n");
}
```



Figure 2: This short program illustrates access to the NT system registry. CPUTYPE retrieves and displays the CPU model and stepping level for the host machine.

SYSMON.C

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```
// SysMon - Simple System Monitor for Windows/NT
// Copyright (C) 1992 Ray Duncan
// PC Magazine * Ziff Davis Publishing

#define dim(x) (sizeof(x) / sizeof(x[0])) // returns no. of elements
#define MAXLINES 4096 // max lines to display
#define MALLOCINCR 4096

#include <stdlib.h>
#include <string.h>
#include <windows.h>
#include <winperf.h>
#include "sysmon.h"

HANDLE hInst; // module instance handle
HWND hFrame; // handle for frame window
HFONT hFont; // handle for nonprop. font

int CharX, CharY; // character dimensions
int LinesPerPage; // lines per page
int CurLine = 0; // first line, current page
int TotLines = 0; // total lines to display
int TopLine = 0; // first line of last page
int DisplayType = IDM_OBJECT; // default display type

char *LinePtr[MAXLINES]; // holds pointers to lines

char szFrameClass[] = "SysMon"; // classname for frame window
char szAppName[] = "System Monitor"; // long application name
char szMenuName[] = "SysMonMenu"; // name of menu resource
char szIcon[] = "SysMonIcon"; // name of icon resource
char szIni[] = "sysmon.ini"; // name of private INI file

DWORD dwPerfDataLen = 0; // size of performance data
PPERFDATA pPerfData; // addr of perf data block
PPERFGROUP pFirstGroup; // addr of first object group
INT iTotGroups; // total object groups
PSTR pTitles; // addr of object title database

//
```

```
Table of window messages supported by FrameWndProc()
// and the functions which correspond to each message.

struct decodeMsg frameMsgs[] = {
    WM_PAINT, DoPaint,
    WM_SIZE, DoSize,
    WM_COMMAND, DoCommand,
    WM_SETFOCUS, DoSetFocus,
    WM_CLOSE, DoClose,
    WM_DESTROY, DoDestroy,
    WM_VSCROLL, DoVScroll, } ;

//
// Table of menubar item IDs and their corresponding functions.
//
struct decodeMsg menuItems[] = {
    IDM_EXIT, DoMenuExit,
    IDM_ABOUT, DoMenuAbout,
    IDM_OBJECT, DoDisplayType,
    IDM_PROCESS, DoDisplayType,
    IDM_REFRESH, DoRefresh, } ;

//
// WinMain(), InitApp(), TermInstance() deleted here -- generic code.
//

// InitInstance --- instance initialization code for this application.

BOOL InitInstance(HANDLE hInstance, int nCmdShow)
{
    HDC hdc; // handle for device context
    TEXTMETRIC tm; // info about font
    RECT rect; // window position & size
    int i; // scratch variable

    for(i = 0; i < MAXLINES; i++) // initialize all line
        LinePtr[i] = NULL; // pointers

    hFrame = CreateWindow( // create frame window
```



Figure 3: Extracts from SYSMON.C, a simple program to retrieve and display performance information from the NT system registry. The full source code can be downloaded from the Programming Forum on PC MagNet as SYSM02.ZIP.

SYSMON.C

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```

szFrameClass,          // window class name
szAppName,             // text for title bar
WS_OVERLAPPEDWINDOW | WS_VSCROLL, // window style
CW_USEDEFAULT, CW_USEDEFAULT, // default position
CW_USEDEFAULT, CW_USEDEFAULT, // default size
NULL,                 // no parent window
NULL,                 // use class default menu
hInstance,            // window owner
NULL);                // unused pointer

if(!hFrame) return(FALSE); // error, can't create window

hdc = GetDC(hFrame); // get device context
hFont = GetStockObject(SYSTEM_FIXED_FONT); // handle for nonprop. font
SelectObject(hdc, hFont); // realize the font and get
GetTextMetrics(hdc, &tm); // the character dimensions
CharX = tm.tmAveCharWidth;
CharY = tm.tmHeight + tm.tmExternalLeading;
ReleaseDC(hFrame, hdc); // release device context

GetWindowRect(hFrame, &rect); // current window pos & size

// read profile for frame window from previous invocation, if any
rect.left = GetPrivateProfileInt("Frame", "xul", rect.left, szIni);
rect.top = GetPrivateProfileInt("Frame", "yul", rect.top, szIni);
rect.right = GetPrivateProfileInt("Frame", "xlr", rect.right, szIni);
rect.bottom = GetPrivateProfileInt("Frame", "ylr", rect.bottom, szIni);

MoveWindow(hFrame, rect.left, rect.top, // force window size & position
rect.right-rect.left, rect.bottom-rect.top, TRUE);

// get display type from previous invocation, default to module list
DisplayType = GetPrivateProfileInt("Frame", "type", IDM_OBJECT, szIni);

// allocate initial buffer to receive performance data
// this buffer will be grown as necessary by GetPerfData
dwPerfDataLen = MALLOCINCR;
pPerfData = (PPERFDATA) malloc(dwPerfDataLen);
if(pPerfData == NULL)
    return(FALSE);

// fetch names of object types from system registry
if(!GetObjectTitles())
    return(FALSE);

// fetch system performance data from system registry
if(!GetPerfData())
    return(FALSE);

// set up our 10 sec. (10,000 msec) timer callback
if (!SetTimer(hFrame, 1, 10000, (WNDPROC) TimerProc))
    return(FALSE);

ShowWindow(hFrame, nCmdShow); // make frame window visible

// simulate a Display menu command to turn on the menu checkmark
// for the current display type, and force update of the window
PostMessage(hFrame, WM_COMMAND, DisplayType, 0);

return(TRUE); // return success flag
}

//
// FrameWndProc --- callback function for application frame window.
// Searches frameMsgs[] for message match, runs corresponding function.
//
LONG CALLBACK FrameWndProc(HWND hwnd, UINT wMsg, UINT wParam, LONG lParam)
{
    int i; // scratch variable

    for(i = 0; i < dim(frameMsgs); i++) // decode window message and
    { // run corresponding function
        if(wMsg == frameMsgs[i].Code)
            return(frameMsgs[i].Fxn)(hwnd, wMsg, wParam, lParam);
    }

    return(DefWindowProc(hwnd, wMsg, wParam, lParam));
}

//
// DoCommand -- process WM_COMMAND message for frame window by
// decoding the menu item with the menuitems[] array, then
// running the corresponding function to process the command.
//
LONG DoCommand(HWND hwnd, UINT wMsg, UINT wParam, LONG lParam)
{
    int i; // scratch variable

    for(i = 0; i < dim(menuitems); i++) // decode menu command and
    { // run corresponding function
        if(wParam == menuitems[i].Code)
            return(menuitems[i].Fxn)(hwnd, wMsg, wParam, lParam);
    }

    return(DefWindowProc(hwnd, wMsg, wParam, lParam));
}

//
// DoDestroy(), DoClose(), DoVScroll(), DoPaint(), DoSize(),
// DoSetFocus(), DoMenuAbout(), AboutDlgProc(), SetCurLine(),
// ConfigWindow(), TimerProc(), AddLine(), EmptyLines(),

```

```

// PaintLine(), RePaint(), SetWindowCaption(), UpdateProfile()
// all omitted here -- see previously published Windows 3.1
// version of SYSMON.
//
//
// DoDisplayType -- process items on Display popup to select
// the type of information to display, then force window update
//
LONG DoDisplayType(HWND hwnd, UINT wMsg, UINT wParam, LONG lParam)
{
    HMENU hMenu; // scratch menu handle

    hMenu = GetMenu(hwnd); // update popup checkmark
    CheckMenuItem(hMenu, DisplayType, MP_UNCHECKED);
    DisplayType = wParam;
    CheckMenuItem(hMenu, DisplayType, MP_CHECKED);
    SendMessage(hwnd, WM_COMMAND, IDM_REFRESH, 0); // update window
    return(FALSE);
}

//
// DoRefresh -- rebuild the information for display according to
// the currently selected display type, then refresh the window.
//
LONG DoRefresh(HWND hwnd, UINT wMsg, UINT wParam, LONG lParam)
{
    EmptyLines(); // discard old output

    // fetch fresh copy of system performance data block
    GetPerfData();

    // call the appropriate list walking routine
    // according to the currently selected display type
    switch(DisplayType)
    {
        case IDM_OBJECT:
            WalkObjects();
            SetWindowCaption("Objects");
            break;

        case IDM_PROCESS:
            WalkProcesses();
            SetWindowCaption("Processes");
            break;
    }

    ConfigWindow(); // configure scroll bar etc.
    RePaint(); // refresh the window

    return(FALSE);
}

//
// WalkObjects -- Lists the object types found in the system
// registry and the number of counters and instances for each.
//
VOID WalkObjects(VOID)
{
    char temp[256];
    INT iCurGroup;
    PPERFGROUP pCurGroup;

    // format title for itemized data
    AddLine("Group Description Counters Instances");

    // begin at first object group
    pCurGroup = pFirstGroup;

    // walk through object groups, printing for each the position,
    // object type name, number of counters, and number of instances
    for(iCurGroup = 0; iCurGroup < iTotGroups; iCurGroup++)
    {
        wprintf(temp, "%3d %4s %5d %5d", iCurGroup,
            pCurGroup->ObjectNameTitle,
            pCurGroup->NumCounters, pCurGroup->NumInstances);
        AddLine(temp);

        // advance to next group of objects
        pCurGroup = (PPERFGROUP) ((PBYTE) pCurGroup +
            pCurGroup->TotalByteLength);
    }
}

//
// WalkProcesses -- displays process instances and counters from the
// system performance registry.
//
VOID WalkProcesses(VOID)
{
    char temp[256];
    PPERFGROUP pCurGroup;
    PPERFINSTANCE pCurInst;
    PPERFCOUNTERS pCurCounters;
    INT iCurInst;
    INT iTotInst;

    // find appropriate object group within the performance data
    pCurGroup = FindGroup("Process");
}

```

SYSMON.C

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```

// bail out now if there is nothing to display
if(pCurGroup == NULL)
{
    AddLine("Process object group was not found!");
    return;
}

// extract pointer to first instance and total number of
// instances from the header for the process object group
pCurInst = (PPERFINSTANCE) ((PBYTE) pCurGroup +
    pCurGroup->DefinitionLength);
iTotInst = pCurGroup->NumInstances;

for(iCurInst = 0; iCurInst < iTotInst; iCurInst++)
{
    // convert UNICODE process name to ASCII and display it
    wcstombs(temp, (LPWSTR) ((PBYTE) pCurInst + pCurInst->NameOffset),
        pCurInst->NameLength/sizeof(WCHAR));
    AddLine(temp);

    // advance to next process instance
    pCurCounters = (PPERFCOUNTERS) ((PBYTE) pCurInst +
        pCurInst->ByteLength);
    pCurInst = (PPERFINSTANCE) ((PBYTE) pCurCounters +
        pCurCounters->ByteLength);
}

//
// GetPerfData() - obtain performance data block from the
// system registry. The size of the data cannot be known in advance
// so the buffer is expanded incrementally until it is big enough.
//
BOOL GetPerfData(VOID)
{
    INT iCurGroup;
    PPERFGROUP pCurGroup;
    DWORD dwBufferSize = dwPerfDataLen;

    while(ERROR_MORE_DATA ==
        RegQueryValueEx(HKEY_PERFORMANCE_DATA, "Global",
            NULL, NULL, (PSTR) pPerfData, &dwBufferSize))
    {
        dwPerfDataLen += MALLOCINCR;
        dwBufferSize = dwPerfDataLen;
        pPerfData = (PPERFDATA) realloc(pPerfData, dwPerfDataLen);

        if(pPerfData == NULL)
        {
            MessageBox(hFrame, "GetPerfData malloc failed!", szAppName,
                MB_ICONSTOP | MB_OK);
            return(FALSE);
        }
    }

    // point to first object group within the data block and
    // save total number of object groups
    pFirstGroup = (PPERFGROUP) ((PBYTE) pPerfData + pPerfData->HeaderLength);
    iTotGroups = pPerfData->NumObjectTypes;

    // point to the first group of objects
    pCurGroup = pFirstGroup;

    // look up titles for each object type and save pointer
    // within the object group's header structure
    for(iCurGroup = 0; iCurGroup < iTotGroups; iCurGroup++)
    {
        pCurGroup->ObjectNameTitle = (LPWSTR)
            FindTitle(pCurGroup->ObjectNameTitleIndex);

        // advance to next group of objects
        pCurGroup = (PPERFGROUP) ((PBYTE) pCurGroup +
            pCurGroup->TotalByteLength);
    }

    return(TRUE);
}

//
// GetObjectTitles() - retrieve titles for each of the object
// types from the system registry. The retrieved data, which is
// referred to as the title database, is in the form of a series of
// pairs of ASCII strings. The first string of a pair is the object
// type index in decimal, the second string is the title. The entire
// set of strings is terminated by an extra null byte.
//
BOOL GetObjectTitles(VOID)
{
    HKEY hKey;
    char chClass[10];
    DWORD dwType;
    DWORD cSubKeys;
    DWORD cbMaxSubkey;
    DWORD cbMaxClass;
    DWORD cValues;
    DWORD cbMaxValueName;
    DWORD cbMaxValueData;
    DWORD cbSecurityDescriptor;
    DWORD cbClassSize = 10; // sizeof(chClass);
    FILETIME ftLastWriteTime;

```

```

// get handle for subkey holding object type indexes and titles
if(ERROR_SUCCESS != RegOpenKeyEx(HKEY_LOCAL_MACHINE,
    "Software\\Microsoft\\Windows NT\\CurrentVersion\\Perflib\\409",
    0, KEY_QUERY_VALUE, &hKey))
{
    MessageBox(hFrame, "RegOpenKeyEx failed!", szAppName,
        MB_ICONSTOP | MB_OK);
    return(FALSE);
}

// get maximum size of value data for values reached thru this subkey
if(ERROR_SUCCESS != RegQueryInfoKey(hKey, chClass, &cbClassSize, NULL,
    &cSubKeys, &cbMaxSubkey, &cbMaxClass, &cValues, &cbMaxValueName,
    &cbMaxValueData, &cbSecurityDescriptor, &ftLastWriteTime))
{
    MessageBox(hFrame, "RegQueryInfoKey failed!", szAppName,
        MB_ICONSTOP | MB_OK);
    RegCloseKey(hKey);
    return(FALSE);
}

// bump maximum data size value for safety
cbMaxValueData++;

// allocate memory to hold the incoming data
pTitles = malloc(cbMaxValueData * sizeof(TCHAR));

if(pTitles == NULL)
{
    MessageBox(hFrame, "GetObjectTitles malloc failed!", szAppName,
        MB_ICONSTOP | MB_OK);
    RegCloseKey(hKey);
    return(FALSE);
}

// now retrieve the index and title data
if(ERROR_SUCCESS != RegQueryValueEx(hKey, "Counters", NULL, &dwType,
    (LPBYTE) pTitles, &cbMaxValueData))
{
    MessageBox(hFrame, "RegQueryValueEx failed!", szAppName,
        MB_ICONSTOP | MB_OK);
    RegCloseKey(hKey);
    return(FALSE);
}

// release the handle for the subkey
RegCloseKey(hKey);
return(TRUE);
}

//
// FindTitle() -- look up the object type index in the title database
// that was read by GetObjectTitles(). Return a pointer to the title
// string if a match is found, otherwise return a pointer to "Unknown".
//
PSTR FindTitle(INT TitleIndex)
{
    INT i; // scratch object index
    PSTR p = pTitles; // start of title database

    while(*p)
    {
        i = atoi(p); // convert index string
        p += strlen(p) + 1; // point to title string

        if(i == TitleIndex) // is this desired index?
            return(p); // yes, return addr of title

        p += strlen(p) + 1; // no, go to next index
    }

    return("Unknown"); // no match was found
}

//
// FindGroup() -- Searches for the object group which has the
// specified title. Returns pointer to the beginning of the group's
// instance storage if match is found, otherwise a NULL pointer.
//
PPERFGROUP FindGroup(PSTR GroupName)
{
    INT iCurGroup;
    PPERFGROUP pCurGroup;

    // point to the first group of objects
    pCurGroup = pFirstGroup;

    // compare title for each object type against supplied string
    for(iCurGroup = 0; iCurGroup < iTotGroups; iCurGroup++)
    {
        // if titles match, return pointer to first instance
        if(!strcmp((PSTR) pCurGroup->ObjectNameTitle, GroupName))
            return(pCurGroup);

        // advance to next group of objects
        pCurGroup = (PPERFGROUP) ((PBYTE) pCurGroup +
            pCurGroup->TotalByteLength);
    }

    return(NULL); // no match was found
}

```


Since NT systems can vary widely in configuration, application mix, and resource usage, the size or characteristics of the performance data cannot be predicted in advance. Consequently, the performance data block has been designed to be "self-describing." That is, the block is assembled out of several different, rather simple structures that can vary in size and can be iterated as many times as needed.

Each structure within the performance data block has a header, and size fields and pointers within the headers help an application traverse the data block, pick out the data it's interested in, and format the data for display. Title strings for the various types of objects and counters that are found in the performance data block can be found in another location in the registry, the so-called title database, under the key

```
\HKEY_LOCAL_MACHINE\SOFTWARE
\MICROSOFT\WINDOWS NT
\CURRENTVERSION\PERFLIB\409
```

The title strings are linked to their cor-

responding object or counter types by arbitrary index values that are synchronized with the performance data block. The entire construct is rich enough that a performance analysis and display program can be expected to cope with object types or counters that don't even exist when the program is written.

In the next installment of this column, we'll examine the structure of the performance data block in more detail. Meanwhile, Figure 3 contains a partial listing of SYSMON.C, a simple program to retrieve and format information from the performance data block. In this version, SYSMON has only two options: to display a list of the types of objects that are found in the performance data block, or to display a list of the active processes in the system. Figure 4 shows SYSMON in action. Next issue, we'll see a more complete version of SYSMON that also dis-

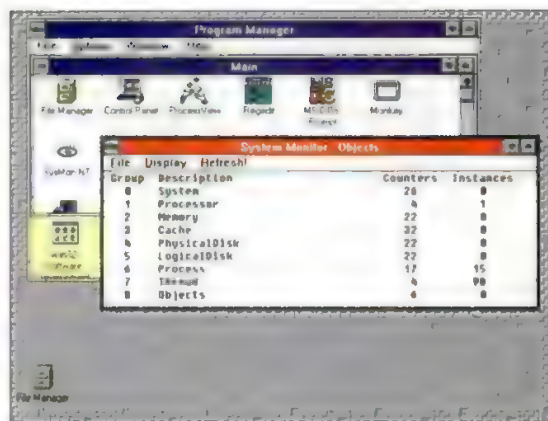


Figure 4: SYSMON in action, displaying a list of system object types and the numbers of their instances and counters, using data obtained from the system registry.

plays the actual performance information associated with each type of object.

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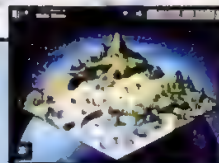


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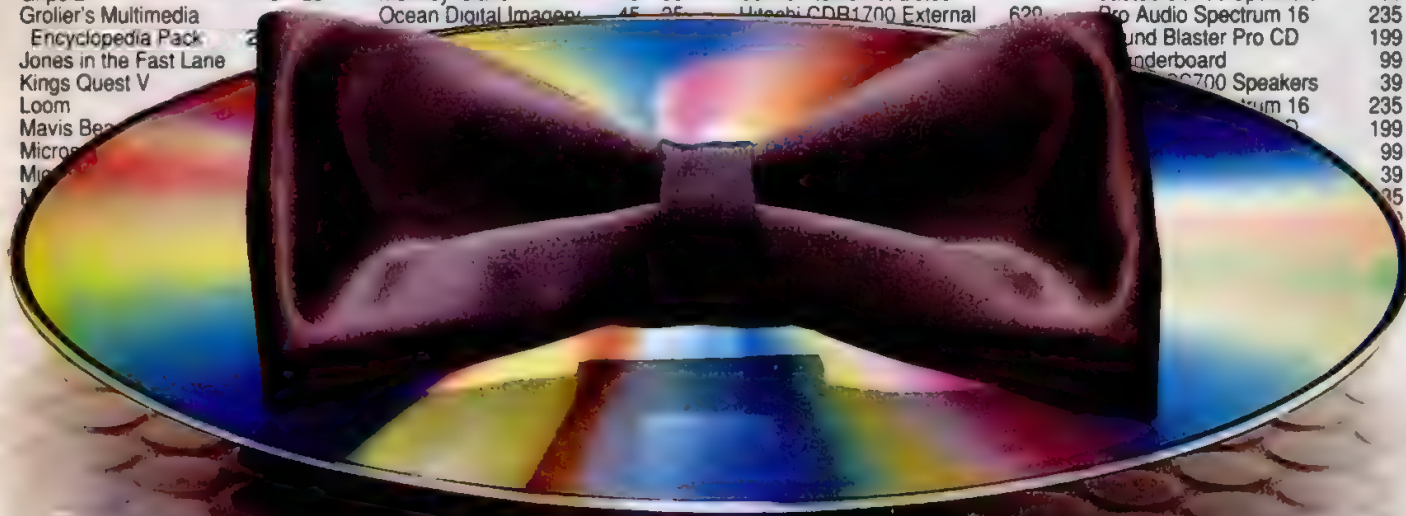
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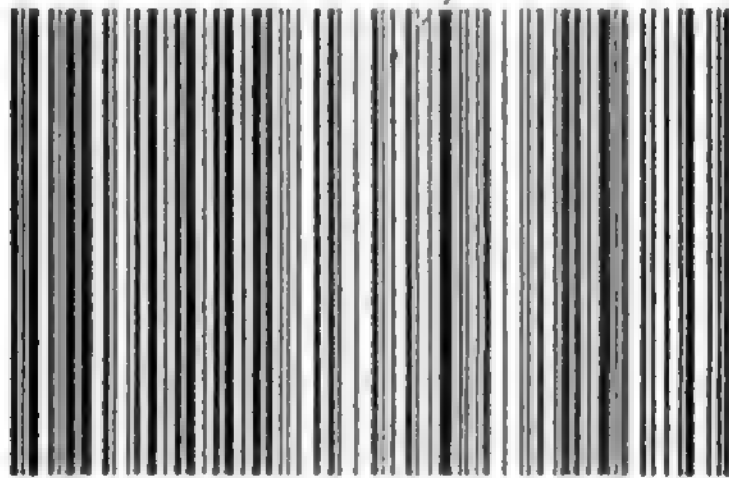
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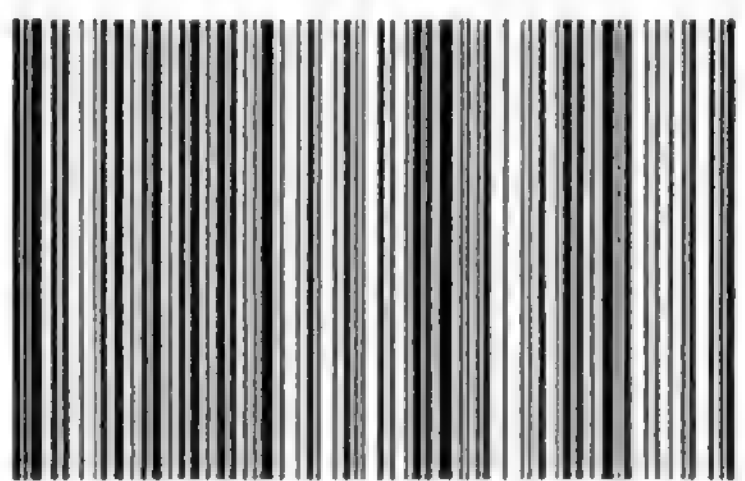
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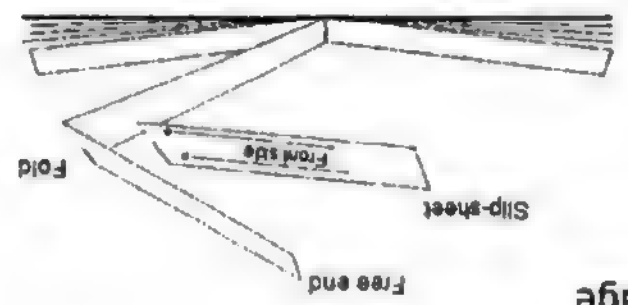
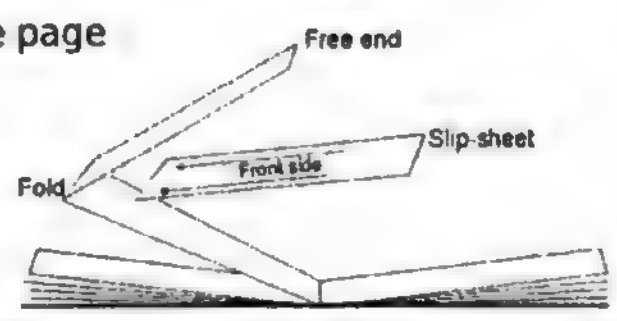
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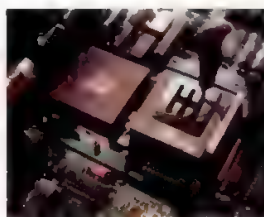
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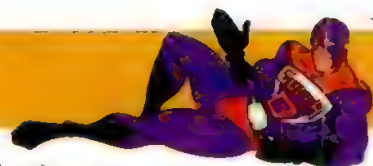


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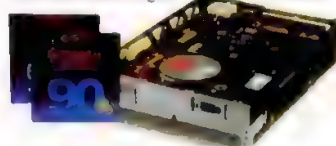
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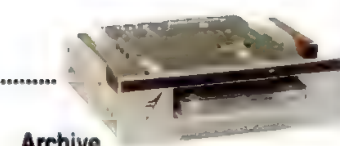
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		Illustrator Windows	389	Optima 96 + Fax 96	399	Copy II PC 6.0	39	Just Write	165
By Design for WP	65	Image Pals	169	PM14400FX Send/Rec Fax	389	Direct Access Windows	CALL	LetterPerfect	99
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PCs

INSTALLING IDE DRIVES

❷ My system has a 40MB IDE (integrated drive electronics) hard drive, and I want to add a 125MB IDE drive. I read that you need a terminating resistor on the last hard drive in your system. I've set the jumpers for master and slave drive settings, but I can't determine what or where the resistor might be. Do I need to worry about this?

Timothy M. McLaughlin
via CompuServe

► **PC MAGAZINE:** Since you can connect more than one hard disk to a single controller, the controller needs to know when it's accessing the last disk. A terminating resistor does just this: It's an electrical termination that informs the controller signal that it has reached the last disk. If you have more than one terminating resistor—or none at all—you may experience unpleasant side effects such as unreliable performance or non-functioning hard disks; you may even risk permanent damage to components, including your controller.

Actually, an IDE drive is the only hard disk interface you're likely to encounter that does *not* need a terminating resistor. ST-506 (used with MFM and RLL hard drives), ESDI, and SCSI controllers all require some form of termination.

You can install up to two IDE drives in a system by configuring one as the master and the other as the slave. IDE drives have their controller circuitry included as part of the disk drive unit (rather than residing on a separate expansion card, as is the case with most controllers). Hence, when you attach a second drive, you need to give one priority (the master); DOS will always access that drive first.

You can use a cable with three connectors to put two IDE drives in a computer: one connector for the interface to the computer, the others for the two hard disk drives. Unlike some disk controller designs, it doesn't matter whether the

Our Advisors

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master drive is attached to the end or the middle connector. Its status is determined by jumper settings on the drive itself. Some drives only have two jumper settings: master or slave. Others have a third setting that's used when there is only one drive in the system.

Unfortunately, these jumper settings are rarely marked on the drive, and few vendors provide this level of technical detail when they sell you a system. You can

often get the information you need by calling your system vendor or the manufacturer of the drive. Another excellent source of information is *The Hard Disk Technical Guide* by Douglas T. Anderson, published by Micro House Inc. (List price, \$59.95; P.O. Box 17515, Boulder, CO 80308; 800-926-8299, 303-443-3388.) This book provides technical details and jumper settings for dozens of controller cards and hundreds of hard disk drives, making it a priceless reference for anyone who needs to configure a hard disk.—*Alfred Poor*

Peripherals

PRINTING GRAPHICS ON LASERJETS

❷ I have an Excel worksheet with borders and other fancy formatting. I've noticed that it takes much longer to print on a LaserJet II than on a IIP, even though the IIP is a slower printer. I've heard these two printers handle graphics differently; is this why one is slower?

Bob Smedley
via CompuServe

► **PC MAGAZINE:** Many people are surprised to discover that there are significant differences between various models of HP LaserJets in the same Series. The LaserJet Series II does print slower than the IIP because it has no support for ras-

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ter (bitmapped) graphics compression. This means it uses 8 bits to describe 8 dots as they will print on the page. If you have a large graphic, such as a long line or shaded areas, this can result in a sizable string of data. At 300 dots per inch, that's 90,000 bits of information for a single square inch.

HP engineers realized that this long data stream would take time to transmit from the computer to the printer, even using a fast parallel port. So with the LaserJet IIP printer (which came out after the Series II), HP added a new command to its Printer Control Language (PCL) and support for three graphics compression modes.

The command is Esc * b # M. Substituting a value of 0 for # means no compression (Mode 0); a value of 1 indicates the RLE (run-length encoding) compression scheme (Mode 1) will be used; and a value of 2 specifies TIFF (Tagged Image File Format) PackBits compression (Mode 2) will be used.

With the introduction of the LaserJet III came a new version of PCL, version 5, and delta row compression (Mode 3). Unlike Modes 1 and 2, which only analyze a single line at a time, this process compares the contents of successive rows within the graphic and only stores the changes for each row.

The PC Magazine Labs' Hardware Benchmark Tests include a PCL 5 torture test that evaluates data compression. The test prints an image of the PC Magazine Labs' logo at a size of about 1/2 inch by 3/4 of an inch. The bitmapped image in PCL format is 6,779 bytes. Using PackBits compression as supported by a LaserJet IIP, the same image is only 5,343 bytes, which is about a 21 percent reduction in size. Using delta row compression, the logo is reduced to just 2,011 bytes, or a 70 percent reduction!

When the LaserJet IIIP was introduced, it added yet another compression mode known as adaptive compression (Mode 5). This technique uses all four prior modes (no compression, RLE, TIFF PackBits, and delta row) and chooses the one that results in the smallest amount of data for a given portion of the image. Our test logo came out at only 1,479 bytes, or a 78 percent compression. Hence, what started out as a 5-minute transmission on a LaserJet II (at 6,799

bytes) now takes just over a minute on a LaserJet IIIP.

Not all applications take advantage of these compression modes, but Windows print drivers do, which explains why the Excel worksheet printed so much faster on the IIP than on the Series II. If you're printing lots of graphics, the IIIP or the new LaserJet 4 will give you the greatest image compression available.

Operating Environments

SIMULATING SFT ENTRIES

TIP With the advent of upper memory managers, several utilities that save conventional memory by moving DOS system data into upper memory have become popular. Many of these utilities extend the System File Table (SFT), creating space for additional file handles in upper memory and linking it to the SFT chain. This technique can save as much as 14K of conventional memory, depending on the number of SFT entries moved to upper memory.

However, Windows 3.0 and 3.1 may fail to start if there aren't enough SFT entries in conventional memory. During kernel startup under versions of DOS

later than 3.31, Windows attempts to calculate the size of the System File Table. The algorithm fails if Windows can't locate three SFT handles linked to the CON device in consecutive low memory. The symptoms of such failure are:

- Windows 3.0 Real or Standard mode reports "Required DOS Version 3.1 or higher," and exits from startup.
- Windows 3.0 Enhanced mode exits from startup without a message.
- Windows 3.1 reports "Unsupported DOS version."

Figure 1 shows a simple batch file workaround that simulates three SFT entries for the CON device in conventional memory by setting variables in the environment. (You can download this batch file from the Utilities/Tips Forum on PC MagNet archived as HIFILE.BAT.) As you can see, the three occurrences of the string "CON" are exactly 59 bytes apart (counting the 0 terminator for each variable). Windows will find "CON" three times in the master environment or, if the master environment is loaded high, in Windows' own local environment.

It's important to get the spacing exactly right. This batch file works for DOS versions 4.x and 5.x. If you use a version of DOS later than 3.31 but before 4.0, re-

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HIFILES.BAT

Complete Listing

```

REM HIFILES.BAT
SET W1=CON 89012345678901234567890123456789012345678
SET W2=CON 89012345678901234567890123456789012345678
SET W3=CON 8
WIN.COM %1
SET W1=
SET W2=
SET W3=

```



Figure 1: This batch file helps Windows get started when the System File Table is loaded in upper memory.

move six characters from each of the variables W1 and W2, thus spacing the three "CON" strings 53 bytes apart.

*Philip B. Gardner
Circle Pines, Minnesota*

► **PC MAGAZINE:** When you include the line FILES=60 in CONFIG.SYS, you're requesting a System File Table big enough to hold information about 60 files. Each time an application opens a file, it gets a *file handle* from DOS; this file handle is effectively an index to an entry in the SFT. (Yes, it's possible to open a file without using a file handle, but that technique is obsolete). An individual program is normally limited to 20 file handles, 5 of which are preopened by DOS. Multiple Windows applications can run at once, each with a default limit of 20 open files, but the *total* number of files open by all programs can't be more than the number of entries in the SFT.

If you ran enough programs at once under Windows, you could conceivably use up every entry in the SFT. Windows attempts to avert this disaster by adding to the SFT. Windows 3.0 expanded the SFT to 255 entries; Windows 3.1 reduced it to 127. The problem noted by Mr. Gardner occurs during this process.

The size of an SFT entry is fixed for every DOS version up to 5.0, but Windows attempts to determine the SFT size by *observation*. It scans conventional memory seeking three evenly spaced occurrences of the string "CON" and takes the distance between them to be the size of one SFT entry. Since DOS itself opens three consecutive SFT entries for the CON device, this technique usually works. But if a utility program moves that portion of the SFT to upper memory (memory above 640K and below 1MB), Windows won't find it.

HIFILES.BAT overcomes this prob-

lem by placing a trio of ersatz SFT entries in conventional memory, where Windows can find them. All that's important is that the characters C, O, N, and space appear three times, starting 59 bytes apart. If you've run into the problem described here, just start Windows by running HIFILES.BAT. And for more information on the SFT, take a look at the November 12, 1991, Tutor column.

—Neil J. Rubenking

Word Processing

MACROS WITH MULTIPLE FUNCTIONS

✓ **TIP** If you write macros and like to assign them Alt-key combinations, sooner or later you're going to run out of possible key assignments. One solution is to keep related functions in a single macro.

One way to coax multiple functions out of a macro is to use the {STATE} command to detect the current status of some feature in WordPerfect, such as whether Block is active. You can use {IF}

to have the macro do one thing or another, depending on the current state.

A less obvious technique is to add a {WAIT} command to the macro, use the {LOOK} command to see if a key was pressed during the wait, and then branch to one action or another, depending on whether a key was pressed.

Figure 2 shows a macro that uses both techniques to lowercase a defined block, the current character, or the current word the cursor is on. When you start it, the macro first looks to see if you've already defined a block. If you have, it gives the command to switch to lowercase. If not, it waits a short time for an optional keystroke. If you don't press a key, the macro proceeds to block the current character and lowercase it. However, if you press a key—any key—it blocks the entire word the cursor is on and lowercases it. Of course, the technique will work just as well for uppercasing, in a nearly identical macro that substitutes U for the L after each {Switch} command.

*John Land
Encinitas, California*

► **PC MAGAZINE:** The macro shown in Figure 2 works, but if you attach this to an Alt-key and then type the key twice in succession without releasing the Alt first, you'll find some garbage (specifically "=" ~) typed into your file. This happens because you're actually running the macro a second time, nested within the first run. You could bulletproof the macro by using one of the user interface commands, such as {CHAR}, but then you would have to type a second key in every case and have the macro check to

LCASE.WPM

Complete Listing

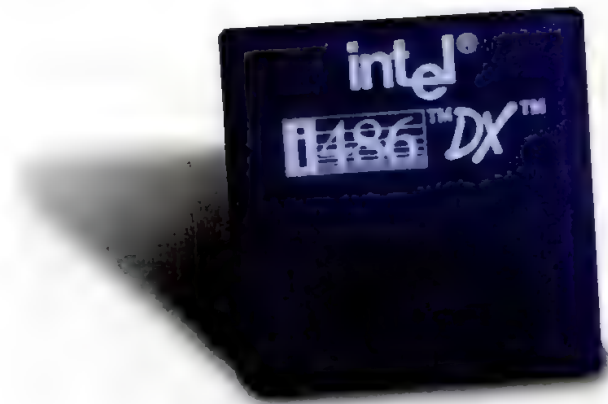
```

(DISPLAY OFF)
(IF){STATE}&128"                (;)if·block·on,·LC·block"
  {Switch}L
(ELSE)
  {WAIT}5"
(;)response·time:·vary·to·liking"
  {LOOK}key"
  (IF)"(VARIABLE)key"="""      (;)LC·char·if·key·hit·once"
    {Block}{Right}{Switch}L
  (ELSE)                        (;)LC·word·if·key·hit·twice"
    {Word Right}{Block}{Word Left}{Switch}L{Word Right}
  (END IF)
(END IF)

```

Figure 2: If you block text before invoking this macro, it will lowercase the text. Otherwise, it will either lowercase the current character, or if you type a second keystroke within 0.5 seconds, it will lowercase the current word.

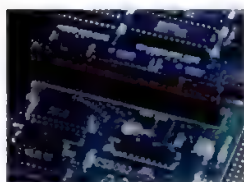
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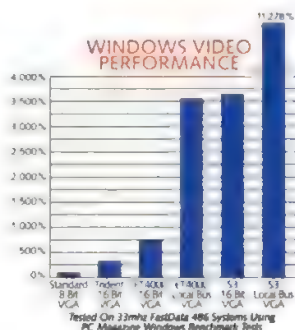
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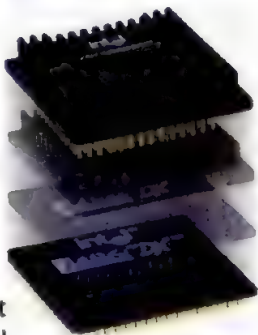


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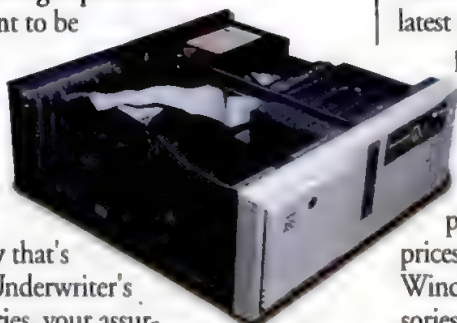
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Every desktop FastMicro PC comes with dual cooling fans. It has a main fan that's quieter than fans in ordinary PCs - plus it includes a special second fan that comes on only when the system gets warm. A cooler system lasts much longer - a concern particularly when upgrading to higher heat-producing clock doubler chips.



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Our desktop case is uniquely engineered to provide the highest quality and maximum expandability in a space saving design. It has a total of seven drive bays to accommodate all of the storage options our customers tell us they want to be able to add in the future. It also has extra protection against electrical interference, unlike the weaker systems others sell. It also includes a



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Conner 212Mb Higher Performance Drive.

FastMicro ups the ante with Conner's CP-30204 212mb IDE hard drive standard in 486/Pro systems. Conner has a reputation for building the most reliable drives on the market. Couple this with a 12 millisecond access time and up to 8MB/sec. data transfer rate and you won't want to gamble on a less reputable drive. No wonder Conner is now the #1 manufacturer of hard disks in the world!

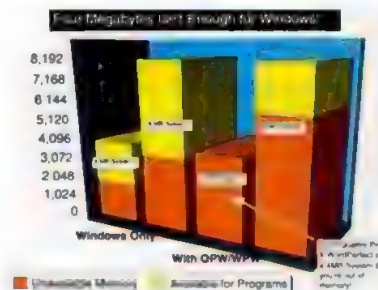


CONNER

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Running Windows? Don't run out of memory! When Windows runs low on memory, it starts using your hard drive like memory.

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- Upgradable to Overdrive Processors.
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- VESA Standard Non-Interlaced 14" Super VGA color monitor with 800x600 @ 72hz & 1024x768 @ 70hz and Edge-To-Edge Video.
- Dual Intelligent Cooling Fans.
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- Microsoft Windows 3.1
- Microsoft Serial Mouse.
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FastMicro backs up all FastData PC's with the most comprehensive service in the business. Seven day a week toll-free technical support is included for as long as you own your FastData PC. In the unlikely event a part should fail during the one year warranty, we'll express ship you the replacement part. If we still can't resolve the problem, we'll send GE on-site or replace the system



GE Computer Service

at no charge.

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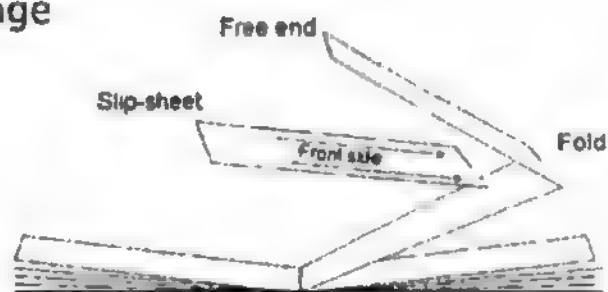
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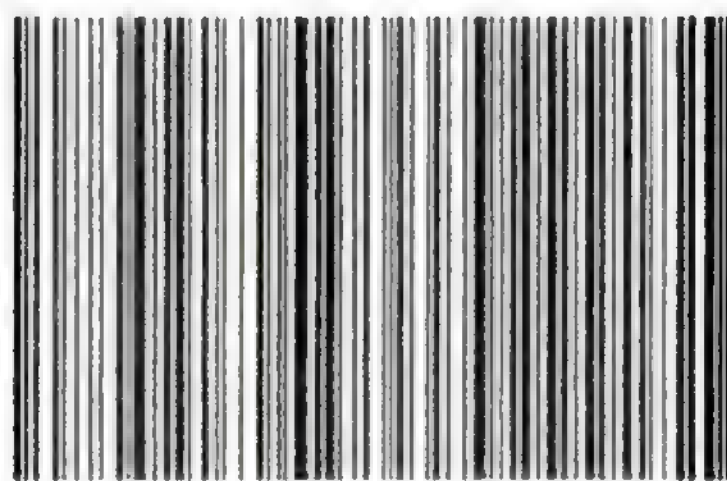
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1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



GbsSlipSheet-001

Inverted Foldout slip-sheet

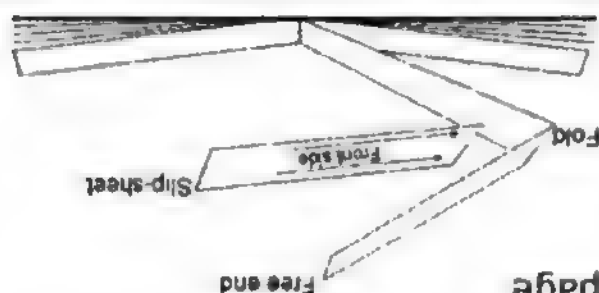
Folded edge of the page

1. Open the foldout page
2. Insert this sheet with

1. Front side touching the free page
2. Arrow pointing to the fold

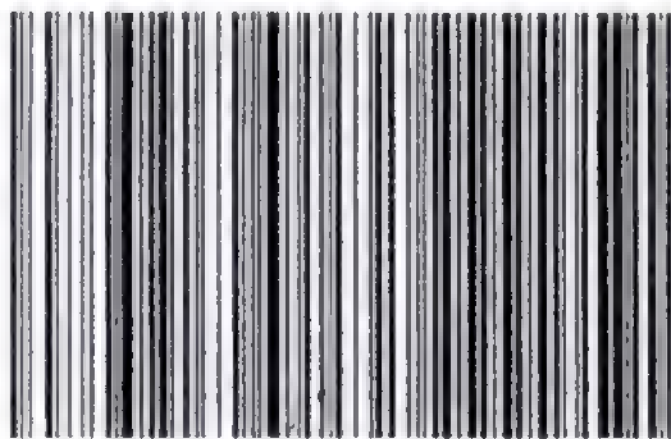
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



Gbs5lip8ack-0018

Back

1. Follow instructions on the other side

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The best computer deserves the best software and FastMicro includes some of today's hottest software at no extra charge! Choose any two of the following titles and you'll get the latest versions complete and ready to run. Everything's included and you get full manufacturer support (unlike some other 'bundles'). The products come in special FastMicro boxes - retail boxes shown.

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WordPerfect is the #1 selling word processing software and the Windows version is loaded with features. It includes the ability to create & edit tables, equations, lists and graphics.

You can even edit graphics created

with other programs! Plus, it works with

your WordPerfect for DOS files and uses familiar WordPerfect commands so your transition to Windows is easy.

PC Tools 8.0

The latest version of the top selling utility software! PC Tools 8.0 adds an all new DOS desktop with integrated application menu & manager, file viewer & manager, scheduler, and desk accessories. You also get Central Point's award-winning backup and a hot new version of Anti-Virus. PC Tools also includes DiskFix, FileFix, Undelete, Unformat, Disk Edit, Defragmenter, Cache and more! Central Point Commute lets you remotely run Windows or DOS applications and you get new RamBoost Memory Optimizer too!

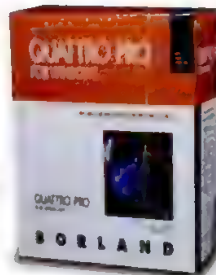


Quattro Pro for Windows

"Quattro Pro for Windows is worth the wait" proclaims PC Magazine. QPW uses spreadsheet notebooks to easily organize your spreadsheets. Click your right mouse button and Object Inspectors lets you change attributes instantly! Speedbars give you those one-click shortcuts that

change depending on what you're working on! Interface Builder lets you build applications without programming.

"QPW comes with a separate Database Desktop application - a beautifully designed query-by-example tool" says PC Magazine, "QPW's graphs are gorgeous and include rotatable 3-D types as well as options to adorn them." Need we add more?



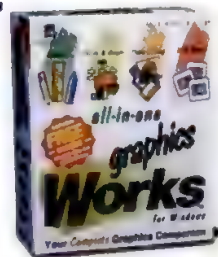
Paradox 4.0

Paradox is the most advanced relational database ever created for the PC. Now it's the fastest. For first time users or application developers, Paradox provides the ease of use and power you need! New Application Workshop, Paradox's application generator, lets you easily

develop custom applications. Paradox also has automatic multiuser support and is network ready. Combine this with the full suite of development tools and SQL connectivity and Paradox is the database of choice!

Graphics Works for Windows

With five applications in one, Graphics Works from Micrografx gives you complete graphic tools for Windows. Includes Windows Draw! - the hot selling package that lets you create graphics compatible with your other Windows programs. It also includes new Photo Magic! - the photo editing software that comes with hundreds of photos you can or modify and use in you documents (plus you'll have photo realism on-screen with FastMicro's true color video). You get a charting tool and the leading organization charting software for Windows. Plus you get a bonus CD with over 1,000 photos and 10,000 pieces of clip art you can use as-is or customize with Graphics Works!



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Introducing FastMicro's 486/Valueline.

Don't need all the extra features of our 486/Pro Series? Then the 486/Valueline is right for you. This system is truly a price breakthrough! FastMicro delivers a high performance 486 system at a low end price. Others can only offer a 386/SX for less than \$1000 or substitute an imitation 486 that's more like a 386. FastMicro puts 25MHz 486SX power in your hands. Plus this isn't a 'bare' system, you get a system that's complete and ready-to-run right out of the box, including a Super VGA color monitor and card.

Loaded with Memory & Storage

FastMicro also includes four full megabytes of high-speed SIMM memory! You can

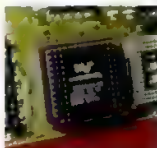
even expand the memory to a total of 32MB. Of course, how can you also expect to get a hard drive at this price? Well, FastMicro includes a quality Conner hard drive with an unbelievable 85MB capacity. Plus, since it's a standard IDE drive, you can easily add a second hard drive later.



CONNER

Upgradable to Overdrive Processors!

The best part of this system is that you get legendary FastMicro upgradability too! Besides upgrading the memory and drive, you can upgrade later to a faster Intel processor. This system is completely Intel OverDrive™ compatible; which means you can upgrade your FastData 486 system all the way to a 66 MHz 486DX/2! And like all FastMicro systems, you can upgrade monitors, drives, etc. when you order.



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GE Computer Service



4SX/25

\$999

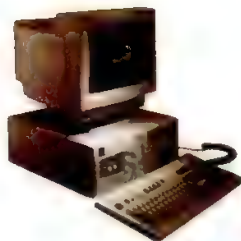
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- 16 bit SVGA card.
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- Professional Tower case
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- Windows 3.1
- Microsoft compatible Hi-Res. mouse

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- Intel 50MHz 80486 Microprocessor w/ built-in cache and math coprocessor
- 8MB 70ns RAM; expandable to 32MB
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- SVGA Windows Accelerator with 1MB
- 14" 1024 X 768 SVGA Non-Interlaced Color Monitor
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- Professional Tower case
- 101 key enhanced keyboard
- MS-DOS 5.0
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- Intel 66MHz 80486DX2 Microprocessor w/ built-in cache and math coprocessor
- 8MB 70ns RAM; expandable to 32MB
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- SVGA Windows Accelerator with 1MB
- 14" 1024 X 768 SVGA Non-Interlaced Color Monitor
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CIRCLE 095 ON READER SERVICE CARD

LCASE2.WPM

Complete Listing

```

(DISPLAY OFF)
(IF)(STATE)&128"      (:)if·block·on,·LC·block"
  (Switch)L
(ELSE)
  (WAIT)3"      (:)response·time:·vary·to·liking"
  (LOOK)0"
  (IF EXISTS)0"
    (WAIT)2"
    (LOOK)1"
    (IF EXISTS)1"      (:)LC·Line·if·key·hit·three·times"
      (Home)(Right)(Block)(Home)(Left)(Switch)L(Home)(Right)
    (ELSE)      (:)LC·Word·if·key·hit·twice"
      (Word Right)(Block)(Word Left)(Switch)L(Word Right)
    (END IF)
  (ELSE)
    (Block)(Right)(Switch)L (:)LC·char·if·key·hit·once"
  (END IF)
(END IF)

```

Figure 3: This version of the lowercase macro builds on the version shown in Figure 2 to add the ability to lowercase the entire current line by typing a third keystroke. It also substitutes the [IF EXISTS] command for the [IF] command to eliminate the possibility of entering garbage in your text, and it uses numbers for variables so it will work with WordPerfect 5.0 as well as 5.1.

see what character you typed. A better choice is to use the [IF EXISTS] command, as shown in Figure 3, rather than the [IF] command to test to see if the key was typed. You can download both macros from the Utilities/Tips Forum on PC MagNet archived as LCASE.ZIP.

Also note that you can easily extend this concept. If hitting a key once when nothing is blocked lowercases the current character and hitting a key twice lowercases the current word, then a simple extension is to hit the key three times to lowercase the entire current line. However, a triple key macro seems the maximum comfortable limit.

In addition to showing how to use the [IF EXISTS] command, Figure 3 shows an extended version of the macro that will let you lowercase character, word, or line. Figure 3 also uses numbers for variables, rather than names, which means it will work in WordPerfect 5.0 and 5.1.

As always when entering WordPerfect macros, enter the commands shown in uppercase by typing Ctrl-PgUp, then picking the command from the list. Enter the commands shown in upper- and lowercase by typing Ctrl-V, then typing the appropriate command.—*M. David Stone*

CREATEDATE AS TIME STAMP?

TIP In the May 26, 1992 issue, you explain how to lock the Date field to create a time and date stamp. However, it is

much easier to create a time and date stamp by using the CreateDate field instead. Simply insert the CreateDate field, or record a macro that will insert it for you, and you have a finished stamp, since WinWord does not update the CreateDate field.

*John Tanzer
West Sussex, England*

► **PC MAGAZINE:** This approach may look attractive at first glance, but it's worth mention mainly to warn you not to use CreateDate as an equivalent to a locked Date field. Not only is CreateDate the wrong choice for stamping date and time on multiple notes within a file, it is a dangerous choice for time stamping even one note per file.

CreateDate returns the date and time that the document was created, not the date the field was entered. If you maintain multiple notes within one file, and time stamp each one, they will all show the same date and time, no matter when you entered each note.

Even if you enter only one note per file, CreateDate can still get you in trouble. Consider, for example, what happens if you select the note with the CreateDate field, open a second file, and copy the note to the second file. When you first copy it, the copied version of the field will show the creation date of the original file. As soon as you update fields in the second document, however, the field result

will change to the creation date of the file you've copied to.

If you never have reason to update the fields in the new document, you may not run into this problem. However, you can get a nasty surprise if you have your print options set to automatically update fields. (In order to see the current setting, choose Tools, Options, and then Print. If the Update Fields check box is checked, WinWord is set to automatically update the fields.)

The moral: Reserve the CreateDate field strictly for when you want precisely what the field gives: the date the particular file was originally created.

—*M. David Stone*

Spreadsheets

DATE DIFFERENCES

TIP Recently I was faced with the need to calculate the difference between two dates and break the result out into a number of years, number of months, and number of days. I found no simple solution. Leap years, the varying lengths of months, and arithmetic based on the number 12 all complicated the calculation.

I solved the problem by creating an Excel worksheet with separate cells for the Years_Difference, Months_Difference, and Days_Difference components of the answer. In these cells, I wrote the following formulas:

Years_Difference:

```

=IF(DATE(YEAR(Later_Date),
MONTH(Earlier_Date),DAY(Earlier_Date))<=Later_Date,
YEAR(Later_Date)-YEAR(Earlier_Date),
YEAR(Later_Date)-YEAR(Earlier_Date)-1)

```

Months_Difference:

```

=IF(DAY(Later_Date)<DAY(Earlier_Date),
IF(MONTH(Later_Date)<=MONTH(Earlier_Date),
12+MONTH(Later_Date)-1-MONTH(Earlier_Date),
MONTH(Later_Date)-1-MONTH(Earlier_Date)),
IF(MONTH(Later_Date)<MONTH(Earlier_Date),
12+MONTH(Later_Date)-MONTH(Earlier_Date),
MONTH(Later_Date)-MONTH(Earlier_Date)))

```

Days_Difference:

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WITH CHANGING
TECHNOLOGY?
PICK A NUMBER.**



340

433

425



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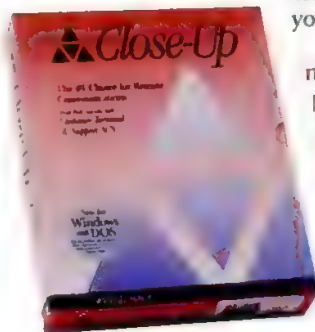
340DX also available in full profile chassis.

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CompuAdd Express has just introduced the best thing ever to happen to technical support — our Remote Rescue program. Using Close-Up 4.0 remote communication software, our support technicians now can use a modem to talk with your PC and solve problems online.

They'll actually be able to diagnose hardware and setup problems and properly configure your system for you — instead of relaying instructions for you to do it yourself!

Remote Rescue uses Close-Up 4.0, the award winning software program that lets an operator at one system use a modem to view and control



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Express Scalables are ideal for the many computer users whose needs change during the life of their systems. You can tailor a system to your individual needs — no matter where they fall within that spectrum.

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Processor	AMD 386DXL	Cyrix 486DXL	Intel 486SX
Norton SI Rating	42	53	53
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Base System: with 80MB hard drive and 14" NI-HRVGA monitor

another computer. *PC Magazine* called it "The best program you can buy for remote control."

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450

466

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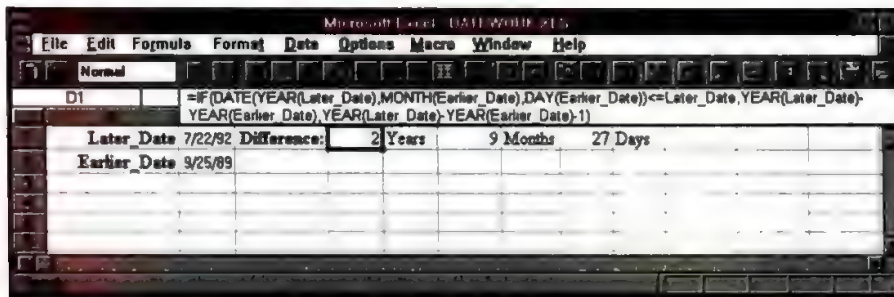


Figure 4: This Microsoft Excel worksheet shows the results of the formulas that report the difference between two dates in years, months, and days.

DATEDIFF.XLM

Complete Listing

	A	B	C
1		DateDiff (custom function; enter as 3-cell horizontal array)	
2			
3		=RESULT(64)	Make the function return an array
4		=ARGUMENT("Date1",1)	Get earlier date.
5		=ARGUMENT("Date2",1)	Get later date.
6	Day1	D Da 1	a a y
7	Month1	=MONTH(Date1)	components
8	Year1	=YEAR(Date1)	
9	Day2	=DAY(Date2)	
10	Month2	=MONTH(Date2)	
11	Year2	=YEAR(Date2)	
12		=IF(Day1>Day2)	If we need to carry the day value...
13		= SET.VALUE(Day2,Day2+Date2-DATE(YEAR(Date2), MONTH(Date2)-1,DAY(Date2)))	Add appropriate value to Day2
14		= SET.VALUE(Month2,Month2-1)	And subtract 1 from Month2
15		=END.IF()	
16		=IF(Month1>Month2)	If we need to carry the month value.
17		= SET.VALUE(Month2,Month2+12)	Add 12 to Month2
18		= SET.VALUE(Year2,Year2-1)	And subtract 1 from Year2
19		=END.IF()	
20	ResultArray	=Year2-Year1	Get year component of result
21		=Month2-Month1	Get month component of result
22		=Day2-Day1	Get day component of result
23		=RETURN(TRANPOSE(ResultArray))	And return as a horizontal array

Figure 5: An Excel custom-function macro that reports the difference between two dates.

```
=IF(DAY(Later_Date)<DAY(Earlier
_Date), Later_Date-DATE(YEAR
(Later_Date), MONTH(Later_Date)
-1, DAY(Earlier_Date)), DAY(Later
_Date)-DAY(Earlier_Date))
```

Figure 4 shows the result of these formulas, with September 25, 1989, as the earlier date and July 22, 1992, as the later date. You name the cells containing them Earlier_Date and Later_Date.

The main principle behind these formulas is that the years, months, and days portions of a date are just like the digits of a number. So, when subtracting one from another, you may have to subtract from a higher-order "digit" and carry the result to the lower-order "digit."

With the months component, this operation is uncomplicated. To subtract September of 1989 from July of 1992, you simply treat July as the nineteenth month of 1991 instead of the seventh month of 1992. It gets messy with the days component, though. How do you know how much to "borrow" from the months component to the days component, when the number of days per month depends on which month you're working with?

My solution is to simply calculate the difference between the serial date of Later_Date and the serial date of one month prior to Later_Date. This always yields the correct amount to borrow.

*Victor L. Harrison
Galesburg, Illinois*

► **PC MAGAZINE:** These formulas work just fine, and by substituting the appropriate function names (replacing MONTH with @MONTH, for example), you can make them work in other spreadsheet programs. But in Excel there's a simpler way: Write a custom function. As Figure 5 shows, the logic is considerably easier to follow in a function macro.

To create this macro, assign the names in A6:A11 to the immediately adjacent cells. For example, assign the name Day1 to cell B6. Assign ResultArray to the range B20:B22. And assign DateDiff to cell B3. When making this last assignment, be sure to select the Function option button in the Define Name dialog box. This tells Excel that you want the macro to be available via the Paste Function command.

The macro takes two arguments—the earlier date followed by the later date—and returns the three components of the difference as a horizontal array. To use the function, therefore, you start by selecting three adjacent worksheet cells in the row where you want the results to appear. Then type the function name and specify the arguments. Terminate the formula by pressing Ctrl-Shift-Enter instead of just Enter. Figure 6 shows the function macro applied to the same dates used in Figure 4.

Note that the contents of the formula bar shown in Figure 6 are enclosed in braces. Excel puts these braces in for you when you press Ctrl-Shift-Enter. Do not type them yourself! (Excel will treat them as text if you do.) If you edit the formula, the braces will disappear while you're editing; they'll reappear when you press Ctrl-Shift-Enter to terminate the edit.

The macro begins with a RESULT(64) statement. This is essential; without it, Excel doesn't know that you want the function to return an array. The two ARGUMENT statements that follow tell Excel that this function requires two arguments and assigns the names Date1 and Date2 to the first and second arguments, respectively. The 1 included in both of these ARGUMENT statements specifies that the function's arguments should be numeric. It isn't essential to include the 1, but doing so gives you a free error trap. If you accidentally supply a text string as an argument for the DateDiff function, the presence of the 1 in the

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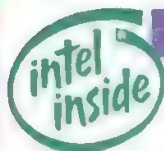
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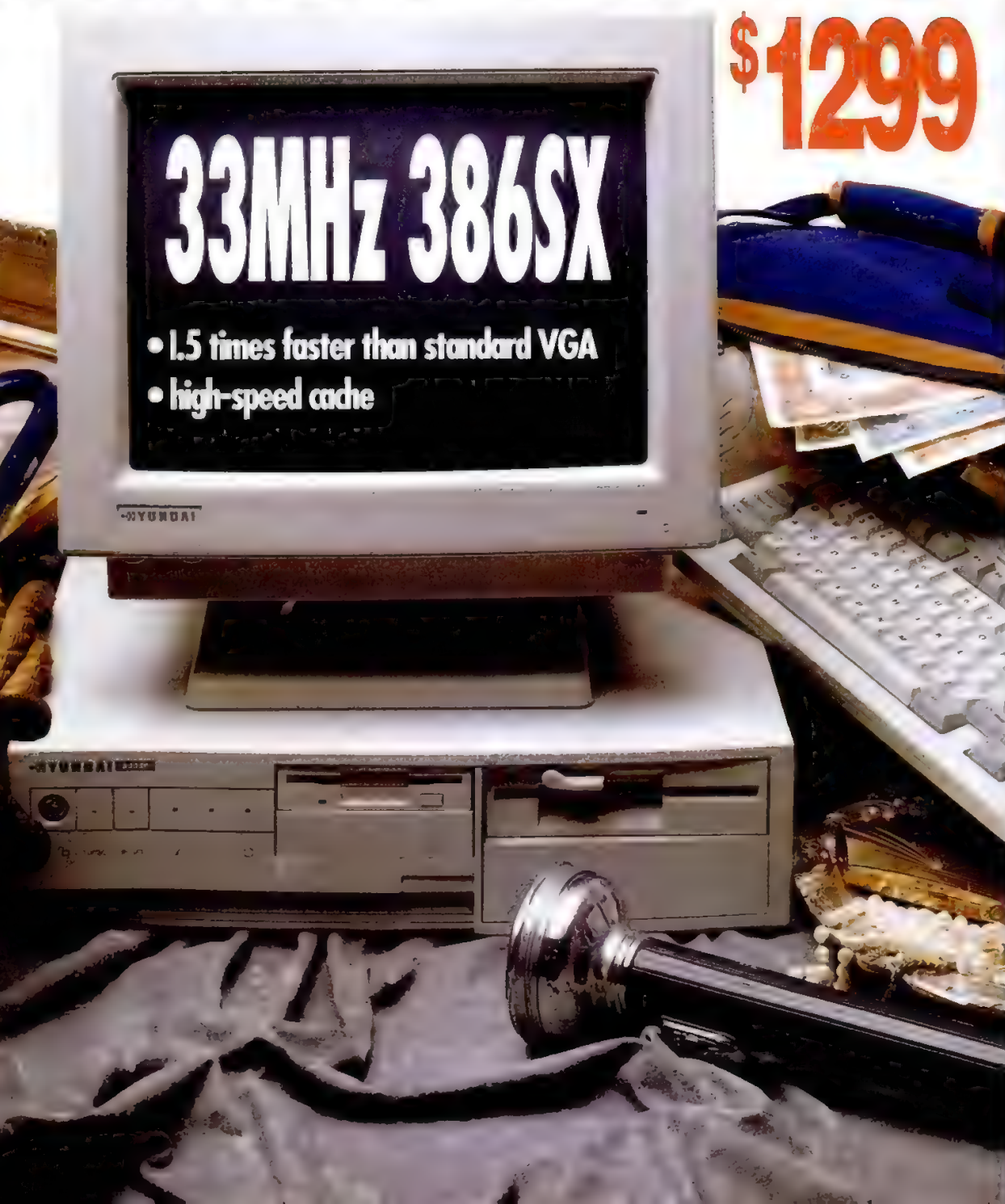


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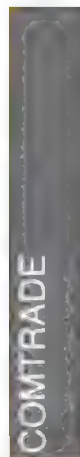
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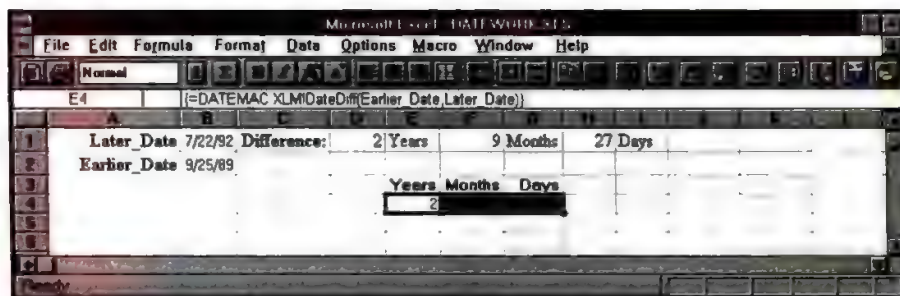


Figure 6: This screen shot shows the custom function macro in Figure 5 in action. Note how the function (as shown in the formula bar) is enclosed in braces.

ARGUMENT statements will cause the function to return #VALUE!. Without the 1, you'll get an ugly macro error.

The next six statements (B6:B11) feed year, month, and day components of the supplied arguments into the cells named Day1, Month1, and so on.

The two IF/END.IF loops at B12:B15 and B16:B19 check to see if borrow and carry operations are required. The SET.VALUE statements within these two loops increment the lower-order date value and decrement the higher-order value, if a borrow is necessary. Finally, after all the required loans have been effected, the formulas in B20:B22 perform the subtraction, feeding results into the range named ResultArray. And the RETURN statement in B23 sends the answer back to the worksheet.

Note the TRANSPOSE function embedded within the RETURN statement. This converts what would otherwise be a vertical array into a horizontal array. If you want the function's results oriented in a column rather than a row, change B23 to read:

```
=RETURN(ResultArray)
```

If you leave the TRANSPOSE in, then you must enter this statement by pressing Ctrl-Shift-Enter. That's because TRANSPOSE itself is an array function! Simply pressing Enter won't give you the results you expect.—Craig



**CLIPPER ENVIRONMENT
SETTING**

TIP I've used a Clipper Summer 87 application that uses the RUN command

to shell to DOS and run a program when I suddenly received a "Program too big" error. After some experimentation, I found that setting the R parameter of the CLIPPER environment variable to a low value makes more memory available. While this alleviates the loss of memory problem, it forces me to run the program from a batch file that begins by setting the environment variable. This is cumbersome, inelegant, and undesirable.

Luckily, a colleague of mine happened to mention a product called Blinker, which is a very fast linker that works with both Clipper Summer 87 and Clipper 5.0. Among its many talents, Blinker lets you burn in to the .EXE file all or some of the Clipper environment settings. (By burn in I mean the value can be stored permanently in the .EXE file, and Clipper will read it from there, so you won't have to set an environment variable.) Now I can set the R parameter of the CLIPPER environment variable and use Blinker to make it part of the executable program, thereby eliminating the need for clumsy batch files.

*Robert C. Ashcraft
Christiansburg, Virginia*

► **PC MAGAZINE:** Blinker and other third-party utilities that let you specify these settings in your executable are indeed helpful. Normally, if you use the CLIPPER environment variable to specify runtime environment settings, you will have to run your program from a batch file. For example, to run your Clipper-compiled accounting application, you might have a batch file that includes

```
SET CLIPPER=E0;  
ACCOUNT
```

Here, the first statement creates the

CLIPPER environment variable while the second runs your accounting program (cleverly named ACCOUNT). The E0 parameter that is stored in the environment variable tells the Clipper runtime not to allocate any expanded memory for its own use. The other possible parameters and their meanings can be found in the Clipper on-line documentation.

While including a batch file is not particularly hard to do, you can't be sure a user of the application won't someday run the executable directly instead of running the batch file. Moreover, it's always most convenient to ship a single executable file without having to worry about including additional files.

Blinker is indeed a very capable linker and a favorite of many Clipper programmers. Among its many strengths, Blinker lets you specify the CLIPPER environment variable value and have it burned in to the executable file. This means you won't have to run a batch file that first sets up the environment variable. When your Blinker-linked application runs, the Clipper runtime will automatically use the values you specified at link time. To prepare your application this way, include the following command in your Blinker link script file (a link script file is just a series of commands stored in a file that your linker uses when linking the application to produce a final executable file):

```
BLINKER EXECUTABLE  
CLIPPER xxx
```

where xxx is what you would normally put in your Clipper environment variable. For example, to tell the Clipper runtime to not allocate any expanded memory, you would use

```
BLINKER EXECUTABLE  
CLIPPER E0;
```

You can also specify whether or not the CLIPPER environment variable settings set at the DOS prompt or in a batch file should override those you embed in the executable. For example, the command

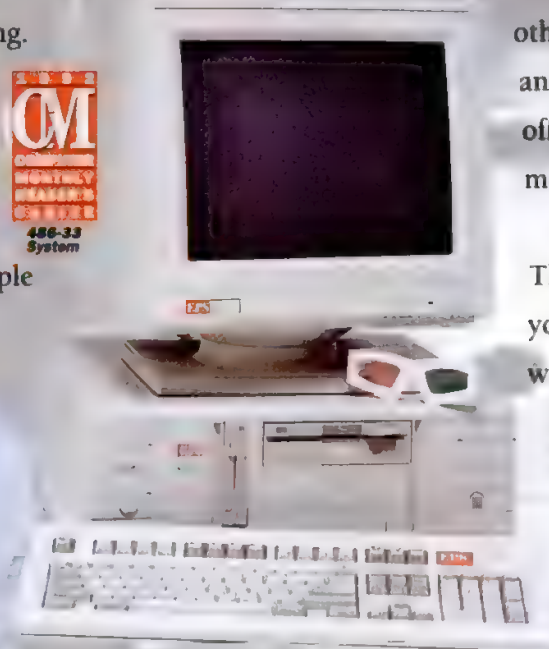
```
BLINKER ENVIRONMENT OVERRIDE
```

allows any Clipper environment variable settings to override Blinker settings at

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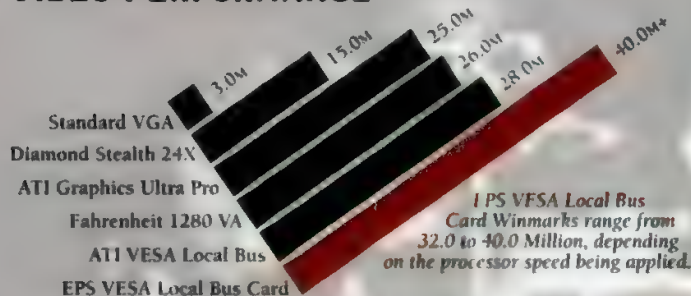
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runtime. You can also change the name of the Clipper environment variable from CLIPPER to something else using the command

```
BLINKER ENVIRONMENT  
CLIPPER <newname>
```

If you're going to let the environment variable override the burned-in settings, it's probably a good idea to come up with an application-specific name, such as ACCOUNT, for example.

As Mr. Ashcraft noted, burning in the environment variable is only one of Blinker's many capabilities. Another is its ability to encrypt in the executable file a serial number of up to 100 characters in length. This way you can embed a different serial number in each shipping copy of your software so that your users can register their copies.

Blinker also includes a suite of built-in functions for use in your applications. One of them, SWPRUNCMD(), is useful for shelling to DOS or running an external program, since it makes almost all of the memory used by the parent program available to the child program. This is accomplished by saving all or part of the parent program's memory image to EMS, XMS, or disk. Blinker, Version 2.0, costs \$299 and is available from Blink Inc. (P.O. Box 7154, Richmond, VA 23221; 804-355-4444).

If you'd rather not spring for a full-featured linker, another product to consider is Sez You, \$149 from Pinnacle Publishing Inc. (18000 72 Ave. S., #217, Kent, WA 98032; 206-251-1900, 800-231-1293). Sez You was created specifically to solve the CLIPPER environment variable problem and, like Blinker, lets you burn in the Clipper runtime environment settings. To use it, link the supplied SYMOD.OBJ file into your executable file and then run the SY5PRO full-screen utility to brand the .EXE file with the settings you want. Sez You also provides a set of built-in functions that you can use in your Clipper programs to inspect and display the values of any of the settings. For example, the SY5Total() function returns the total number of keyword slots (each setting occupies a keyword slot) and SY5Name(n) and SY5Value(n) return the name and value of the keyword in the specified slot number. For

instance, the following code example displays each keyword and its current value:

```
nSlots = SY5Total()  
? "KeywordValue"  
FOR n = 1 TO nSlots  
? SY5Name( n ), SY5Value( n )  
NEXT
```

Here's a sample of the output of this program when run on my machine (compiled with Clipper 5.01):

```
KeywordValue  
U OFF  
INFO OFF  
XSAFE OFF  
NOIDLE OFF  
SQUAWK OFF  
CGACURS OFF  
NOALERT OFF  
BADCACHE OFF  
...
```

Sez You also includes an alternative method of setting the runtime variables that uses configuration files and is designed especially for network use. It can embed serial numbers in your .EXE files, too.—*Sal Ricciardi*

Graphics

MASKING FROM ALPHA TO OMEGA

❗ I recently purchased Aldus PhotoStyler for Windows because everyone describes it as the next best thing to Adobe PhotoShop. But it seems to me that PhotoShop has Alpha-channel masks that are closer to high-end video editing systems. Is there any way I can duplicate the function using PhotoStyler?

*Matthew Komsky
Brooklyn, New York*

► **PC MAGAZINE:** Yes, you can, but first a little background. Remember that a color image is actually composed of three planes or channels: one each for the Red, Green, and Blue (RGB) components used to display color on your monitor.

To achieve full color (defined as 16.7 million simultaneous screen colors), each of the three RGB planes requires 8 bits of information per pixel. This measurement, known as bit-depth, is separate from the number of dots (dpi) or resolution of an image, which usually corresponds to a specific video mode like VGA's 640-by-480.

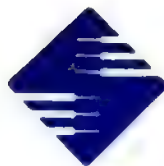
In case you want to review the math: 8 bits per plane delivers 2^8 or 256 shades of either Red, Green, or Blue. To arrive at the total number of possible colors, multiply the red channel by the green channel by the blue channel ($256 \times 256 \times 256$).

In the early days of image editing, true Alpha channels were hardware-dependent and were available only if the graphics adapter was capable of storing 32 bits of information for each pixel in a picture. The three RGB planes (at 8 bits each) utilized only 24 bits of a video board's capabilities. The remaining 8 bits were not assigned to any specific color, but were kept in reserve as an "extra" plane or Alpha channel. High-end image editing systems used the Alpha channel for graphic overlays and special effects. The addition of scrolling text (called titling) over a full-color video image is a good example of an overlay. And special effects include things like one image fading into another.

The good news is that you no longer need a specialized 32-bit graphics adapter to access high-end image-editing functions. Programs like Aldus PhotoStyler for Windows and Adobe PhotoShop on the Mac give you Alpha-channel features via sophisticated masking functions. As a matter of fact, both PhotoStyler and



Figure 7: This shows an effect created by using an 8-bit mask on a full-color image. Note the transformation from color to shades of gray in part of the image.



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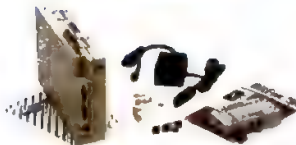
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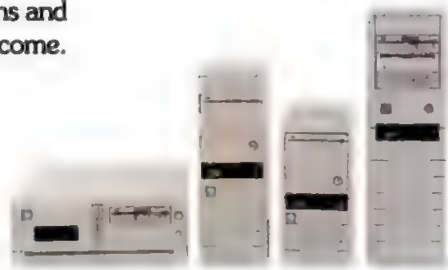
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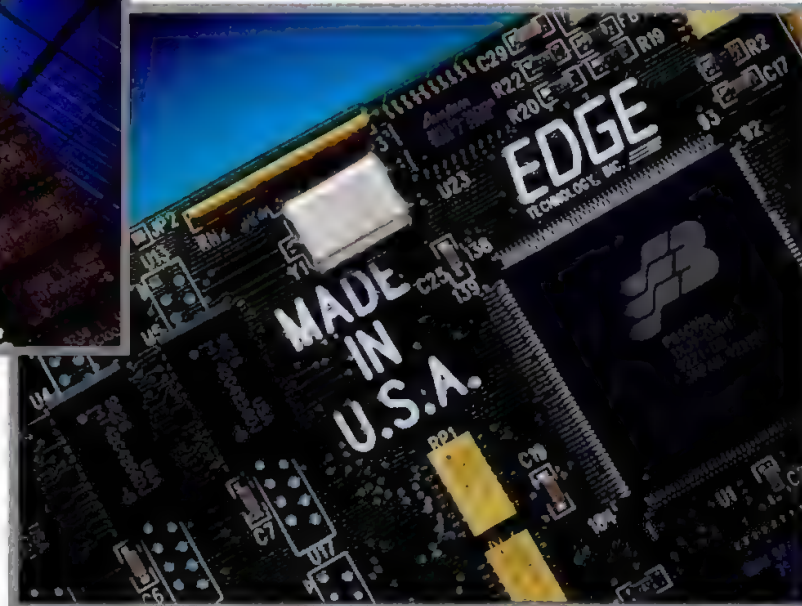
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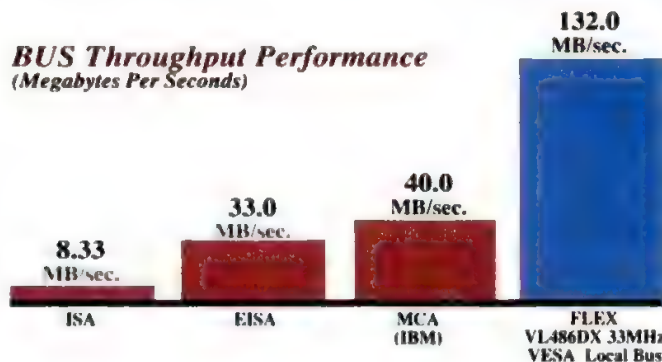
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BUS Throughput Performance (Megabytes Per Seconds)



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Based on WinMarks.

Video performance varies with processor.



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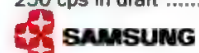
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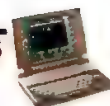
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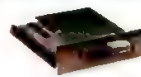
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Figure 8: This is the mask used to obtain the effect in Figure 7.

PhotoShop use 8 bits of information for their masks.

Most computer artists are accustomed to thinking of 8-bit files as 256 shades of gray—ideal for producing realistic monochromatic photos. Simply stated, 8-bit masks are similar to gray-scale images, but instead of 256 shades of gray you get 256 intensity levels. So with an 8-bit mask, you can fade two completely different pictures together. Imagine a woman's face blending into a snarling tiger, or a peaceful country scene transmogrified into an hallucinogenic landscape. The sample image in Figure 7 clearly illustrates this point. Notice the subtle gradations that transform a normal full-color picture to a hard-edged gray-scale image.

Now take a look at the 8-bit mask that is shown in Figure 8 that accomplished that effect. Notice that the original picture was left unchanged in those portions of the mask that are solid black, and that the special effect is strongest in the white areas.

Here's the important point: It is only 8-bit masks that allow you to apply image-editing filters in varying strengths by utilizing the intermediate shades of gray. Most image-editing programs available for Windows still offer only 1-bit or vector-based masks, so they aren't capable of applying a special-effect filter in gradations from weak to strong. Only three programs for the PC currently offer 8-bit masking functions: Aldus PhotoStyler, Computer Associates CA-Cricket Im-

age, and Computer Associates' CA-Cricket Paint.

In truth, Adobe PhotoShop (currently available only on the Macintosh) does beat its PC-competitors on convenience. PhotoShop maintains 16 separate channels for each image. This means that after you fill 3 channels with RGB information, you still have 13 Alpha channels left over for masks. In contrast, Aldus PhotoStyler can only associate one mask—which PhotoStyler refers to as the current selection area—with one picture.

But, because you can export a PhotoStyler selection area to an external .TIF file, you can save as many masks as you like to disk and manipulate the 8-bit information to produce subtle special effects—just like PhotoShop. To reproduce the effect shown in Figure 7, follow these steps:

- First open PhotoStyler and load the sample image FLORA.TIF. To preserve the original image from inadvertent changes, be sure to copy it using the Duplicate command on the Edit menu.

- Use a shortcut to select the entire picture: Click the A button located at the bottom of the Select menu. A dotted line will appear indicating that the whole image is selected, guaranteeing that the mask you create will be exactly the same size as the image.

- Click the Tool icon on the Select palette to open the drop-down menu of options.

- Click the Export Mask option. In the dialog box, type an appropriate name, such as Mask. (If you ultimately want

to save the file to disk, you'll have to rename it in the Save As dialog box.) Make the Mask window the active document.

- Prepare a linear gradient fill. The foreground color should be white and the background black. Double-click on the gradient Fill tool to open the associated dialog box. Adjust the Mixing Controls so that the starting point is at 20, the midpoint 40, and the end point 80. Return

to the document window and draw a vertical gradient fill with white at bottom and black at top. Now you can save this 8-bit .TIF file to disk using the standard Save As command.

- Return to the flowers image by clicking anywhere within its window.

- Open the Tool icon menu (located on the Select palette) and choose the Import Mask command. In the Import Mask dialog box, highlight the Mask file and click OK. When you import this mask, PhotoStyler treats it as the current selection area. Oddly, you'll only see a dotted line around the white portions of the mask or, in this case, only $\frac{1}{3}$ of the canvas. Have faith: The gray-scale information has been preserved and will be used when you apply image-editing filters.

- On the Image menu choose Tune, and then open the Hue and Saturation dialog box. Move the Saturation slider all the way to the left, to a value of -100. You can get an advance look at the effect by clicking on the Preview button, but you must click OK for the filter to take effect. Finally, choose Sharpening Filters on the Image menu, and then click the Edge Enhancement command.

You can use this technique with irregularly shaped masks, and it will work with even more dramatic filters, such as embossing, blurs, and ripple effects.

—Luisa Simone

Networking

DON'T CACHE THE CACHE!

❓ I'm currently installing LANtastic, Version 4.2, and DR DOS, Version 6.0, on a small LAN. Can you advise me about using Artisoft's LANCache versus the version of SuperPCKwik that is included in DR DOS?

Mark McCauley
Fort Worth, Texas

►PC MAGAZINE: We've encountered no problems running LANtastic and LANCache on our own DR DOS server with a compressed drive. Artisoft isn't aware of any serious compatibility problems between LANCache and DR DOS or LANtastic and SuperPCKwik, so either cache should work—but not both at once!

Be careful about running a double cache with any network operating sys-

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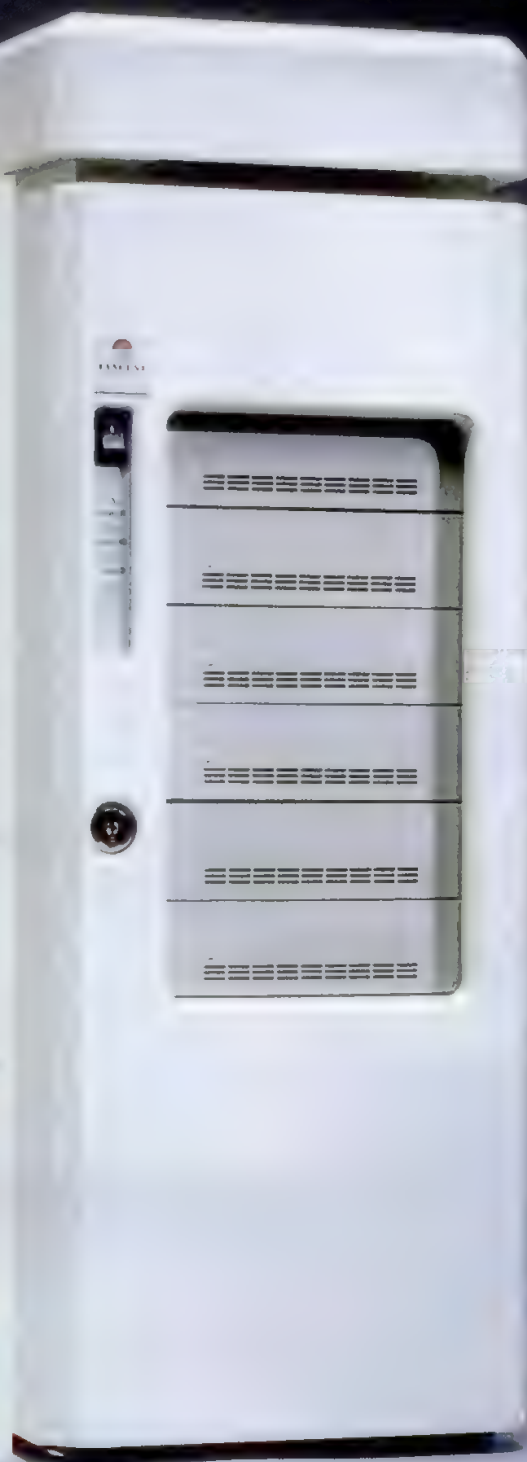
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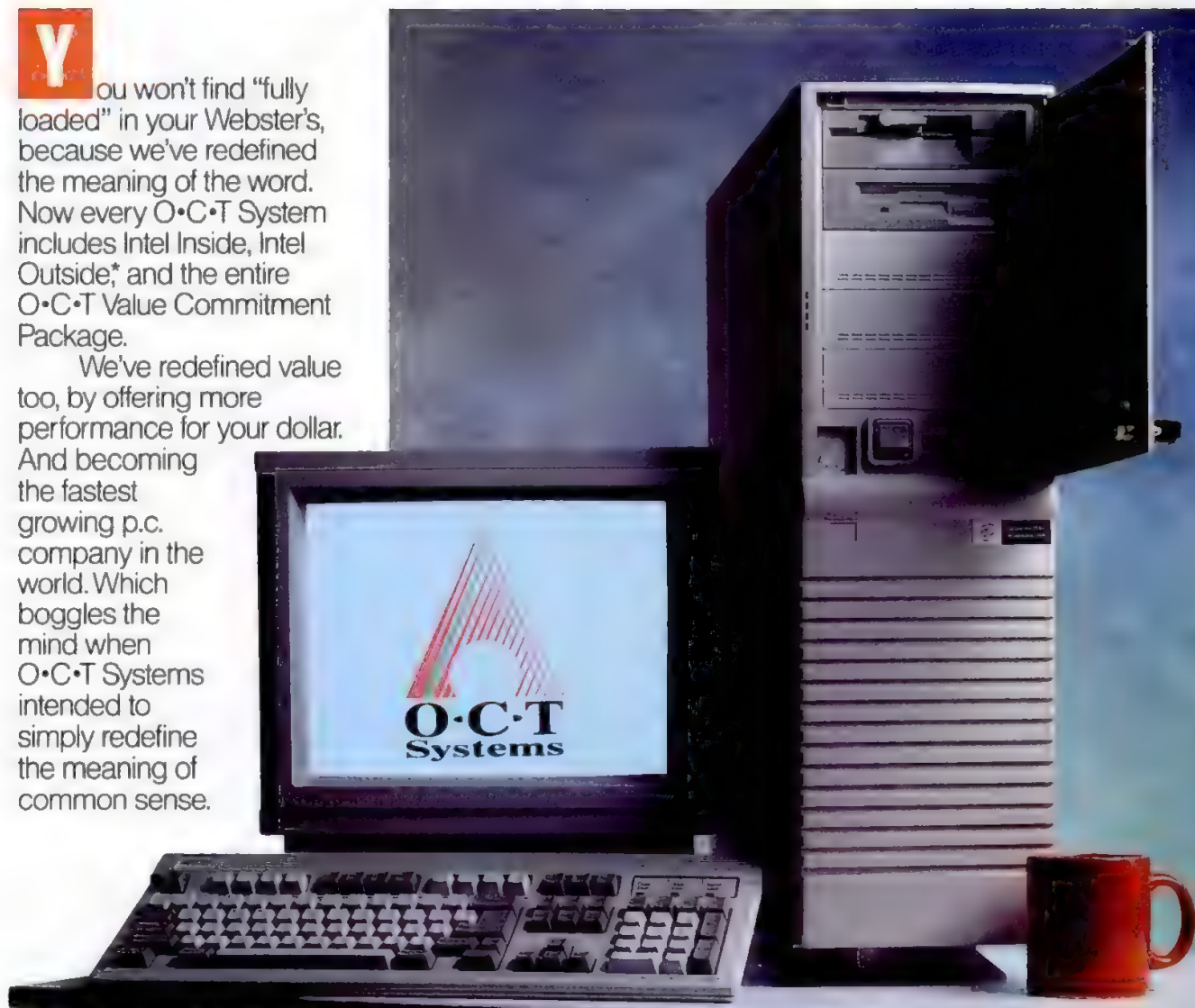
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tem. We often see problems when one cache tries to cache another. Sites running Windows and SmartDrive on NetWare Lite frequently stumble into this trap when they upgrade from Novell's original product—which did not cache—to Version 1.1, which does. The network will operate just fine when traffic is fairly light, but when you try to write a big file or a group of files across the network, the whole process freezes with no error message.

If you use LANtastic on top of DR DOS and run Windows over this setup, make sure you have version 4.10 or later of the network software, which resolved some of the conflicts. LANCache can delay disk writes to improve throughput, so on most tests it will outperform SuperPCKwik. You do, however, take a small risk of data loss if power should fail before the disk is updated. SuperPCKwik also offers write delay, but you have to disable it to use LANtastic. Since this is the safer alternative (and you can't disable it in LANCache), my advice is to use the cache that comes with DR DOS—SuperPCKwik.—*Frank J. Derfler, Jr.*

LAN CABLING COSTS

☛ Recently we requested bids for a 25-node 10BaseT network to be installed entirely within one 24- by 35-foot room. One response listed a charge of \$5,800 for labor, cable, mounting hardware, panels, scanning, and 10BaseT certification. Could this be right? It seems like a lot of money for cabling.

*Walt Flack
via PC MAGNET*

► **PC MAGAZINE:** Cable installation is often the hidden cost surprise in networking. To track down the dollars, let's look at the pieces that go into a 10BaseT setup.

Naturally, you'll need a wiring hub. At the going rate of around \$100 per port, that accounts for \$2,500 of your budget right from the start.

Plenty of wire will hook into that hub. For safety, most sites use *plenum cable*, which doesn't give off toxic fumes in a fire. A good grade runs about 20 cents a foot so; assuming that, on the average, nodes lie 75 feet away, there's another \$375 tacked on to the vendor's expenses. And don't forget wall plates at \$4.75 each

(\$118.75), a patch panel for \$210, and probably \$50 worth of plastic wire wraps and other small hardware, bringing the total to \$3,253.75.

Labor is the biggest variable. With two technicians, each cable requires about 7 minutes per end to prepare, 20 minutes to run, and 10 minutes to certify. Add 1 hour to unpack and clean up and at least another hour for things to go wrong, and the process comes to just over 20 hours. Assuming \$25 an hour for each of two people, the installer's costs add another \$1,000 to reach \$4,253.75. If it's difficult to run the wires through your building's walls, though, labor costs can skyrocket.

Many of a vendor's expenses don't even appear in this simple analysis—money invested in tools and test equipment, for example. Naturally, these contribute to the final tab.

Your network is no better than its cabling system. Cabling is critical to reliability and throughput. In fact, it causes a surprisingly large number of network problems. Doing it right costs more in the beginning, but pays dividends for years.—*Frank J. Derfler, Jr.*

Languages

CLEARING BASIC VARIABLES

► **PC MAGAZINE:** It's often necessary to clear selected variables or array elements in a BASIC program, and there are a number of ways to do this. Clearing an entire array is easy because you can simply use REDIM to erase and recreate it. But clearing an entire TYPE variable requires a lengthy series of slow, code-bloating steps using assignments to each component of the TYPE. You can't use a FOR/NEXT loop, because each TYPE element must be listed explicitly by name:

```
TypeVar.Name = ""
TypeVar.Owed = 0
TypeVar.Date = ""
...
...
```

And while you can quickly clear a string to all CHR\$(32) blanks using `∞ ≤ a f ≈ ork$ = ""`, there's no way to assign any other character.

Clearly, the best way to initialize any block of memory is with an assembly lan-

guage subroutine. Assembly language is extremely fast and doesn't impose any of BASIC's arbitrary restrictions. But many programmers don't own an assembler, and the new QBasic that comes with DOS 5.0 doesn't let you call external non-BASIC routines.

The MEMCLEAR.BAS program in Figure 9 shows how to clear any variable, string, or array—or any arbitrary block of memory, for that matter—without having to deal with external routines or a Quick Library. MEMCLEAR.ASM in Figure 10 contains the assembly language source that was used to derive the DATA values used in MEMCLEAR.BAS. You can download both from the Programming Forum on PC MagNet archived as MEMCLE.ZIP.

The MemClear subroutine does the actual work of assigning the value you specify to contiguous bytes in memory. It begins by checking to see if it has already been called, to avoid the extra time needed to read and assign the DATA items more than once. If it hasn't, each byte of code is read and then inserted into a fixed-length string. Finally, MemClear calls the Absolute routine that comes with all newer versions of BASIC. QuickBASIC users will find Absolute in the QB.LIB and QB.QLB files. BASIC PDS calls these files QBX.LIB and QBX.QLB, respectively, and QBasic supports the Absolute command directly as a built-in statement.

A fixed-length string is used to let MemClear work the same way with either QuickBASIC or BASIC PDS. PDS stores regular strings in a different segment from numeric and TYPE variables, which would require a change to the routine when using that version of BASIC. Using a fixed-length string ensures that the code bytes are stored in the default data segment, regardless of which version of BASIC you're using.

If you're currently using QuickBASIC or QBasic, then you must use VARSEG in the demo portion of this program where the string S\$ is cleared, instead of SSEG, which is meant for BASIC PDS. I used SSEG because it will cause a benign error if you try to run it in QB; had VARSEG been used instead, it would crash a PDS program, requiring the PC to be rebooted.

Note that you can use the assembly

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CIRCLE 112 ON READER SERVICE CARD

MEMCLEAR.BAS

Complete Listing

```
'MEMCLEAR.BAS - shows how to initialize variables to any value
'Copyright (c) 1992 Ethan Winer

DEFINT A-S
DECLARE SUB MemClear (Segment, Address, Size, Value)

TYPE Test
  I AS INTEGER
  L AS LONG
  S AS SINGLE
  D AS DOUBLE
END TYPE

DIM TestType AS Test
TestType.I = 123
TestType.L = -123456
TestType.S = 123.456
TestType.D = -123.456

REDIM A$(1 TO 150)
FOR X = 1 TO 150
  A$(X) = X
NEXT X

SS = SPACES(250)
FOR X = 1 TO 250
  MID$(SS, X, 1) = CHR$(X + 35)
NEXT X

GOSUB Display
PRINT "Press a key to clear the variables"
WHILE INKEY$ = "" : WEND

'not the TYPE and array elements to all zeros, and the string to "A"s
CALL MemClear(VARSEG(TestType), VARPTR(TestType), LEN(TestType), 0)
CALL MemClear(VARSEG(A$(1)), VARPTR(A$(1)), 250 + LEN(A$(1)), 0)
CALL MemClear(ESSEG(SS), RADD(SS), LEN(SS), 65)
....
|----- use VARSEG here instead of ESSEG with QuickBASIC

GOSUB Display
END

Display:
CLS
PRINT "TestType elements:"
PRINT "TestType.I ="; TestType.I
PRINT "TestType.L ="; TestType.L
PRINT "TestType.S ="; TestType.S
PRINT "TestType.D ="; TestType.D
PRINT

;MEMCLEAR.ASM - clears memory to any value
;
;Usage:
;CALL MemClear(BYVAL Segment#, BYVAL Address#, BYVAL NumBytes#, BYVAL Value#)
;
;
;CALL MemClear(SEG Array(Start), BYVAL NumBytes#, BYVAL Value#)
;
;CALL MemClear(SEG Variable, BYVAL NumBytes#, BYVAL Value#)
;
.MODEL Medium, Basic
.CODE

MemClear PROC, Dest:DWord, NumBytes:Word, Value:Word
    MOV DI, Dest
    MOV CX, NumBytes
    MOV AX, Value
    REP STOSB
    RET
MemClear ENDP
END
```

Figure 9: MEMCLEAR.BAS shows how to quickly initialize any BASIC variable to any value, and it works correctly with all versions of Microsoft QuickBASIC, including QBasic and BASIC PDS.

MEMCLEAR.ASM

Complete Listing

```
PRINT "A$( ) elements:"
FOR X = 1 TO 150
  PRINT A$(X);
NEXT X

LOCATE 10, 1
PRINT "SS contents:"; SS
RETURN

ClearCode:
DATA 4B55, 4B6B, 4BEC, 6, 4BC4, 6B7E, 4BA, 6BDB, 4BAE, 8
DATA 4B8B, 4B46, 6, 4BF3, 4BAA, 7, 6B5D, 4BCA, 8, 8

SUB MemClear (Segment, Address, Size, Value) STATIC

IF NOT MemClear THEN 'do this only once
    DIM Code AS STRING * 20
    RESTORE ClearCode
    FOR X = 1 TO 20
        READ Byte
        MID$(Code, X, 1) = CHR$(Byte)
    NEXT X
    Proc = VARPTR(Code)
    BeenHere = -1
    END IF
DEF SEG
CALL Absolute(BYVAL Segment, BYVAL Address, BYVAL Size, BYVAL Value, Proc)
END SUB
```

Figure 10: The assembly language source code underlying the DATA statements in MEMCLEAR.BAS (Figure 9).

language version of MemClear if you have an assembler. Besides saving a few dozen bytes of code, this version allows you to pass variables and arrays directly using SEG instead of VARSEG and VARPTR, saving some additional bytes each time it is used. This alternate syntax is shown in the header comments for the routine.—Ethan Winer



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You can also use this procedure to FORWARD several messages to yourself at one time. Simply note the message numbers as you read them, then, at the Command: prompt, type FORWARD fol-

lowed by the numbers. For example you read messages 3, 4, 5, and 7, you use the command:

FO 3-5,7

Combining and downloading messages using this formula also saves on transmission costs, since it makes one message of many.

Here's another handy MCI tip may save you time. If you're expecting an MCI from someone, there's no need to scan through all your messages. You can quickly find the one you're looking for by entering SC IN FROM followed by the person's last name. So, if you need to find out if Bill Jones sent you a message, simply type:

SC IN FROM JONES

and you'll see any messages he sent. —Alfred Poor □

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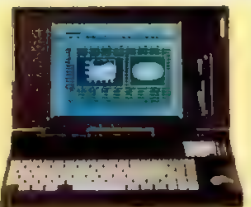
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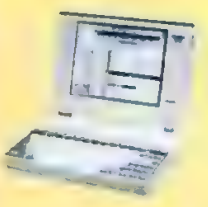
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7120A 120mb 15ms IDE.....299
7213A 213mb 15ms IDE.....399
Microplus (see DTC Controllers)
MC1684 345mb HH ESDI 14ms.....899
MC1568 668mb FH ESDI 14ms.....229
MC1518 1.3gb FH ESDI 14ms.....2139
Plus Development
HardCard IXL 50mb 9ms 16bit.....249
HardCard IXL 105mb 9ms 16bit.....399

DRIVES CONT.

Quantum
LP552A 52mb 9ms IDE.....199
LP5120A 120mb 9ms IDE.....309
LP5240A 240mb 9ms IDE.....579

Teac 1.44mb 3.5" or 5.25" Floppy Drive \$59

Genuine Teac quality at a low price, these high density floppy drives also read, write & format low density floppy disks. They work great with all true 286, 386 & 486 compatibles. 1.44 mb 3.5" drive includes mounting kit and bracket. For rails for 1.2mb 5.25" drive, add \$5.



Seagate
40MB ST351A 28ms IDE Drive.....159
105MB ST3120A 19ms IDE Drive.....249
125MB ST3144A 19ms IDE Drive.....299
245MB ST3283A 12ms IDE Drive.....549
425MB ST4180A 14ms IDE.....679
1.42GB ST41650N 15ms SCSI.....1899

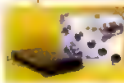
Teac
1.2MB 5.25" Floppy.....59
1.44MB 3.5" Floppy.....59
Toshiba
360K 5.25" Floppy (Black).....59
1.2MB 5.25" Floppy.....59
1.44MB 3.5" Floppy.....59
Western Digital
WDAC280 80mb IDE 20ms.....239
WDAC2200 200mb IDE 20ms.....399

MODEMS

ATI
2400 ETC V.42 Int. / Ext.....75-99
9600/E External MNP V.42bis.....279
Best Data Traveler 9624FP.....109
Everex 2400B Int. Modem.....65
Hayes
Optima 24 + Fax96.....149
Optima 96 + Fax96.....369
Ultra 144 Ext.....669
Pocket Edition 2400 Modem.....119
Intel
Classic 2400 Modem Int. / Ext.....139/159
Substation Int. 100/200.....99/299
Practical Peripherals
2400B Int. Modem Sid/MNP.....79/119
PM9600SA Int. / Ext.....279/299
PM14400FX Int. / Ext.....379/419
USRobotics
9600 Sportster Int. / Ext.....399/449
Courier HST 14,400 Int. / Ext.....539/559
Courier HST 14,400 Dual Sid. Ext.....799
ZOOM
14.4 Int. / Ext.....265/295
2400B Internal Modem.....59
9624 Send/Receive Int. Fax Modem.....79

Optima 9600 \$369

Hayes quality and affordability in this V.32 9600 bps modem. V.42bis boosts throughput to 38,400 bps. It also includes V.42 & MNP 5 error correction and automatic feature negotiation for the most efficient performance.



MICE & INPUT

Key Tronic 101 Keyboard.....59
Logitech
Mouseman Serial right-hand.....65
Mouseman Bus right-hand.....65
Mouseman Cordless.....85
FotoMan.....499
ScanMan 32.....139
ScanMan 32 w/ Catchword.....179
ScanMan 256.....259
ScanMan 256 w/ Catchword Pro.....299
Trackman 925.....75
Trackman Portable.....95
Microsoft
Serial or Bus Mouse only.....83
Serial with Windows.....147
Ballpoint.....119



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Microsoft Mouse \$83

This mouse offers a resolution of 400 points per inch, unprecedented control and a greater degree of accuracy. There's an acceleration feature that moves you across the screen using only a few inches of desk space.



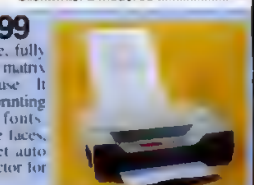
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Epson 3250 \$199

The Epson AP-3250 is the affordable, fully featured, narrow carriage, 24-pin dot matrix printer for small business and home use. It combines excellent high-resolution printing and paper handling and scalable fonts. Features include five built-in I/O type faces, two scalable fonts, built-in 50 sheet auto sheet feeder and an optional push tractor for precise forms handling.

PRINTERS

Canon
BJ10EX Portable.....31
BJ300 / BJ330 Ink Jet.....459 59
Citizen
200GX 9 Pin.....15
GSX-130 24 Pin.....21
GSX-140+ 24 Pin.....21
GSX-145 24 Pin Wide.....36
PM48 Std / Pro.....299 32
GSX-230.....25
GSX-240.....33
Co Star LabelWriter II/Plus.....179 28
Epson Action 3250.....19
Memory Products
HP II, IIP, or III 1/2mb Upgrade.....99-12
OKI 400 1/2mb Upgrade.....129 18
Pana. 4420, 4450 1/2mb Upg.....119 16
NEC
Silentwriter 2 Model 95.....144



NETWORKING

Artisoft/LanTastic
LanTastic for Windows.....165
LanTastic 2 Station Ethernet Kit.....469
Ethernet Additional Stations.....209
Eagle
NE2000 2 Station NW Lite Kit.....419
NE1500 16 Bit 10baseT Adapter.....149
FastData NE2000 16 Bit 10-BaseT.....109
Intel EtherExpress 16 or 16TP.....129
Novell Netware Lite 1.1 w/ DR DOS.....65

VIDEO & MONITORS

ATI
Graphics Vantage 1mb.....219
VGA Basic 16 / Intega.....65/79
VGA Wonder XL24 1mb.....149
Graphics Ultra Pro 1mb/2mb.....449/529
Diamond
SpeedStar24X 16 Million Colors.....159
Stealth VRAM HiColor 1mb.....219
MAQ Colorview 1517x17.....589/1099
Mitsubishi
1410 EGA Monitor.....249
Diamond Pro VGA 14.....369
Diamond Scan 16L.....919

FastData PowerWin VGA \$109

Run Windows six times faster than ordinary VGA! This 1mb VGA card features an ET4000 accelerator chip, maximum 1024x768 resolution, and standard 16 bit ISA compatibility. It also includes a Sierra RAMDAC chip which allows it to display 65,536 colors at the 800x600 mode.



Hitachi
SuperScan 15.....599
SuperScan 17.....1099
SuperScan 20.....1479
Orchid
ProDesigner II 1mb.....199
Farenheit 1280s HiColor.....259
Panasonic C1381 SVGA.....329
Radiux Color Pivot w/ Card.....1099
Selico MC1450.....439
Sony 1304S Multiscan.....599
Video 7
WIN.VGA 512K/1MB.....139/169
V-RAM II Ergo VGA 1mb.....299

CHIPS

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RAMPAT Plus.....145
Cyrix
FastMath387DX 40.....119
FastMath387SX.....75
Intel 287XL.....79
387-DX.....85
387-SX.....79
Overdrive486SX 25.....499
Overdrive486DX 33.....659
Memory - 1mb SIMMS 80ns.....45

Okidata
Okilaser 400.....59
Okidata ML 380.....239
Panasonic
KKP1180 9 Pin.....14
KKP1123 24 Pin.....19
KKP1124 High Speed 24 Pin.....27
KKP1824 24 Pin Wide.....30
KKP2180 Quiet 9 Pin.....17
KKP2123 Quiet 24 Pin.....25
KKP2124 Quiet 24 Pin.....32
KKP21XX Series Color upgrade kit.....39
KKP2624 High Speed Quiet 24 Pin.....39
KKP4410/4430 Laser.....649/899
KKP4450 Laser.....106
KKP4451 Laser.....144
KKP4455 Laser.....169

Panasonic 4410 Laser \$649

The Panasonic KX 4410 includes 5 PPM, HP IIIP emulation, a large 200 sheet paper tray and 2 standard fonts. It works with all current major software programs, has 512K of upgradeable memory, and has an EZ-LCD panel.



QMS PS410.....159
Selico
Smart Label Plus.....13
Smart Label Plus Win. & DOS.....17
Star NX1001.....13
Texas Instruments
MicroLaser PS17.....119
MicroLaser PS35.....134
MicroLaser PS35 Turbo.....159

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FastData Boards
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16bit 256K VGA.....4
2400B Internal Modem.....4
9600B Send/Rec. Fax w/2400B.....6
CGA Card.....4
Ethernet 16bit 10Base-T.....10
IDE 16 Bit Hard/Floppy Disk Cont.....2
IDE HD/FD w/Par2 Serial/Game.....3
MGP Card.....2
Parallel2 Serial/Game Card.....2
RLB 16bit 11 Hard/Floppy Disk Cont.....8
XT 144 Dual Floppy Controller.....3
FastData Monitors
14" Amber or White TTL Mono.....9
14" White VGA Mono.....11
14" Super VGA 1024x768 28 dp.....29

FastData 2496 SR FaxModem \$69

A great value, the FastData 2400 baud internal modem wins 9600 send and 4800 receive fax works with all industry standard PC's and includes BitFax software, and is configurable from COM 1 - COM 4.



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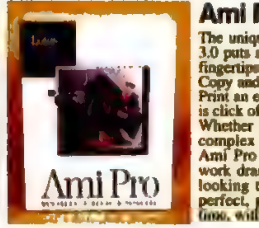
Microsoft Sound System

\$219

The Microsoft Windows Sound System lets you access the rich audio features of the windows operating system version 3.1, and adds many more integrated features of its own. Give your PC voice commands! Package contains software, audio card, microphone and headphones.

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Clarion Professional Developer 3.0	449
Copper 5.01	489
DataEase	509
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dBase IV 1.5	479
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dbXL V	129
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Paradox SE	65
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W PerForm Pro	179
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Rbase 4.0	447
Reflex	159



Ami Pro 3.0

The unique, Windows-based design of Ami Pro 3.0 puts a world of creative power right at your fingertips. Create a frame for text or graphics. Copy and apply text attributes with Fast Format. Print an envelope. Import a picture. All it takes is click of the mouse.

Whether you create basic letters and memos or complex documents with charts and graphics, Ami Pro 3.0 will make your word processing work dramatically easier, and your output better looking than ever. So you can create letter-perfect, picture-perfect documents in half the time, with half the effort.

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W Pagemaker	489
W PFS: Publisher	89
Printshop	33
Printshop Deluxe	49
Public It!	89
W Ventura Publisher for Windows	499
Ventura Database Publisher	179

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Carmen Sandiego Deluxe Edition	45
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Falcon 3.0	45
King's Quest 5 (VGA Vers.)	38
Leisure Suit Larry V	38
W Microsoft Ent. Pack I, II or III	27
Microsoft Flight Simulator	47
Aircraft & Scenery Designer	27
W Microsoft Golf	47
PC Globe or PC USA	35
Science Adventure	53
Sports Adventure	41
Smiley or Smiley for Windows	28
W SimEarth or SimEarth for Windows	39

FINANCIAL

Simply Accounting \$119

Simply Accounting for Windows includes everything you need to get up and running in a flash: A general ledger, accounts receivable, accounts payable, payroll, inventory control and job costing. All functions are fully integrated including: consistent menu structure, automatic transaction posting, pop-up customer, vendor, employee, job, account and inventory list for quick reference during transaction entry.

SOFTWARE

— Windows Software

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ACCPAC Simply Accounting DOS	119
W ACCPAC Simply Accounting Windows	119
DAC Accounting 4.3	85
DAC Bonus Pack 4.3	119
DAC Easy Instant Accounting	35
Managing Your Money	47
W Microsoft Money for Windows	15
W M.Y.O.B.	129
One Write Plus GL, AP & A/R	79
Peacoll 2000	29
Peachtree Basic Acctg.	69
PeachPay	49
W Peachtree Acctg. for Windows	69
Peachtree Complete 6.0 (with DQ)	169
Peachtree Network Accounting	279
W Quicken for Windows	41
Quicken DOS 6.0	41
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DrawPerfect	259
W Freehand	389
Freelance Graphics 4.0	299
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Freelance Competitive Upgrade	89

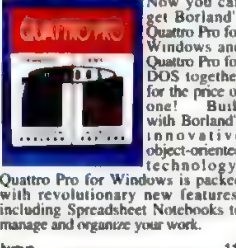
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W MS Quick C Windows	125
MS Quick Pascal	60
Turbo C++ DOS	60
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Turbo Pascal DOS	119
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W 1-2-3 Competitive Upgrades	999a

Quattro Pro for Windows \$299



Now you can get Borland's Quattro Pro for Windows and Quattro Pro for DOS together for the price of one! Built with Borland's innovative object-oriented technology.

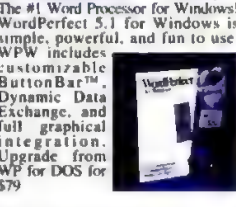
Quattro Pro for Windows is packed with revolutionary new features, including Spreadsheet Notebooks to manage and organize your work.

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W Excel 4.0	299
W Excel 4.0 Competitive Upgrade	119
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Quattro Pro SE	45
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W Ami Pro 3.0 Comp./Vers. Upgr.	95/65
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WordPerfect for Windows \$249



The #1 Word Processor for Windows! WordPerfect 5.1 for Windows is simple, powerful, and fun to use. WPW includes customizable ButtonBar™, Dynamic Data Exchange, and full graphical integration. Upgrade from WP for DOS for \$79.

W WordPerfect for Windows	249
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UTILITIES - WINDOWS



Wired for Sound Pro \$39

This Windows utility for your sound card has 200 realistic sounds. Add personality by attaching sounds and voices to any Windows application, message, icon, or dialog box. The Talking Alarm Clock and Talking Calendar tell you where to be and whom to see. You also get 400 ICONS that talk, 100 cursors, Talking Calculator, Talking Solitaire, Minesweeper, 10 video screen savers, and four other great programs. For sound without hardware ask for Wired for Sound 2.0. Call 800-551-4547 for a live demo then call FastMacro to order.

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W PackRat 4.1	239
W ProComm Plus for Windows	85
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W XTree	Call

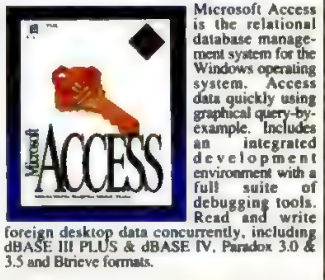


Novell Network v3.11

Network software allows you to share software, data files, printers and more. Support DOS, Windows and OS/2 work stations, connect printers, modems and faxes and automatically back up your data every night. Works with any network card including Token Ring, Arcnet and FastData Ethernet card.

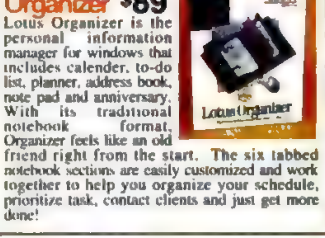
Network v3.11 5 User \$ 579
Network v3.11 10 User \$1279
Network v3.11 20 User \$1749

Microsoft Access \$89



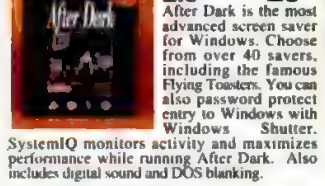
Microsoft Access is the relational database management system for the Windows operating system. Access data quickly using graphical query-by-example. Includes an integrated development environment with a full suite of debugging tools. Read and write foreign desktop data concurrently, including dBASE III PLUS & dBase IV, Paradox 3.0 & 3.5 and Brievie formats.

Lotus Organizer \$89



Lotus Organizer is the personal information manager for windows that includes calendar, to-do list, planner, address book, note pad and anniversary. With its traditional notebook format, Organizer feels like an old friend right from the start. The six tabbed notebook sections are easily customized and work together to help you organize your schedule, prioritize task, contact clients and just get more done!

After Dark 2.0 \$25



After Dark is the most advanced screen saver for Windows. Choose from over 40 savers, including the famous Flying Toaster. You can also password protect entry to Windows with Windows Shutter.

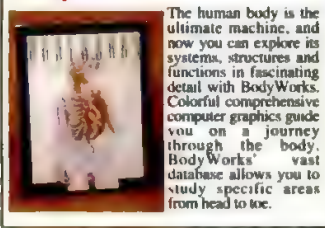
SystemIQ monitors activity and maximizes performance while running After Dark. Also includes digital sound and DOS blanking.

Windows for Workgroups \$359 2 User Kit



New Windows for workgroups is the hot new way to network Windows users to share information and work together. With it, you can share files & printers, send & receive mail, and schedule meetings. It works by itself or with Netware or Lan Manager. Windows for Workgroups is available as a kit with network cards and cables included or as software alone and it works with major network cards (incl. our FastData 10BaseT ethernet card). Additional user kit: \$179. Software only \$65 per user. All pricing is for Windows Upgrade Versions.

BodyWorks \$39



The human body is the ultimate machine, and now you can explore its systems, structures and functions in fascinating detail with BodyWorks. Colorful comprehensive computer graphics guide you on a journey through the body. BodyWorks' vast database allows you to study specific areas from head to toe.

COMPUCLASSICS

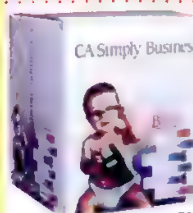
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CAD		Sound Blaster 16	259	Graphics for Windows	788
AutoSketch for DOS	140	Sound Blaster Professional	199	Mathcad 3.1	325
Design Cad 2D 5.0	179	Sound Blaster Pro Multimed Upg Kit Int	479	Mathematics for Windows 2.1	835
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Geniac Cadd 6.0	289	Autodesk Multimedia Explorer	125	System Windows 5.0	739
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Inter Satellite 400 Int.	439	NE 2000 18-Bit w/o Cable	189	Disk Manager (DOS) 5.1	29
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ProComm Plus DOS/Win	74/105	MS Win 3.1 & DOS 5.0 Upgr	145	QDOS 3.5	45
CC Mail Wind Plat Pack 1.11	369	PERSONAL INFORMATION		QEMM 386 6.02	62
Close Up Support/Custom Win 4.0	129	Autosave	64	Spinrite II 2.0	59
Crosstalk Windows 1.2	119	Autosave Europe	79	Stacher 3.0	86
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Scanman 258	282	Quattro Pro Wind/DOS	309	Wordperfect 5.1	272
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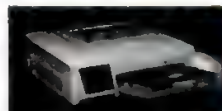
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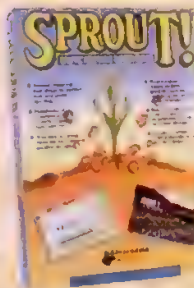
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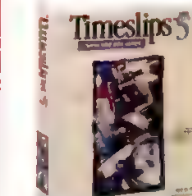


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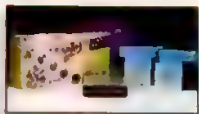
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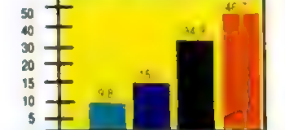
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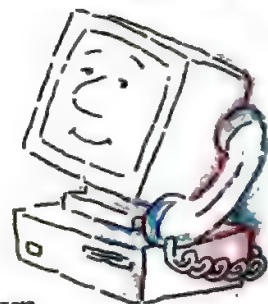
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T2000SX/2200SX	8Meg	PC-PA2002U	309 00
T4400SX, SXC T6400	2Meg	PC-PA2003U	129 00
T4400SX, SXC T6400	4Meg	PC-PA2004U	209 00
T4400SX, SXC T6400	8Meg	PC-PA2005U	369 00
T4400SX, SXC T6400	16Meg	PC-PA2010U	799 00
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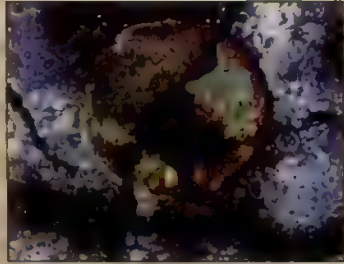
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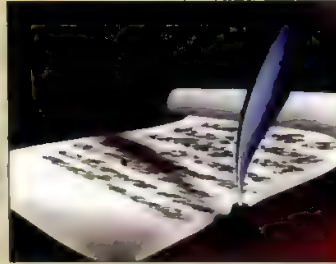
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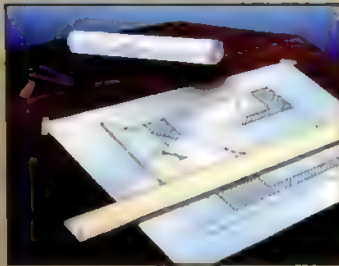
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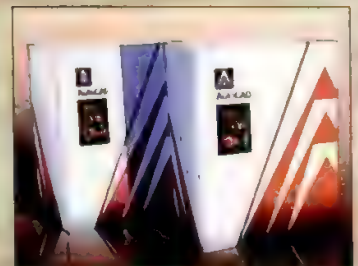
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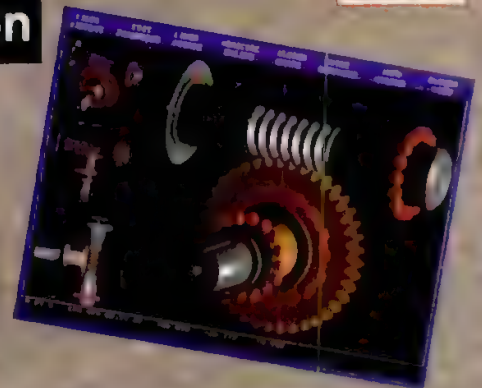
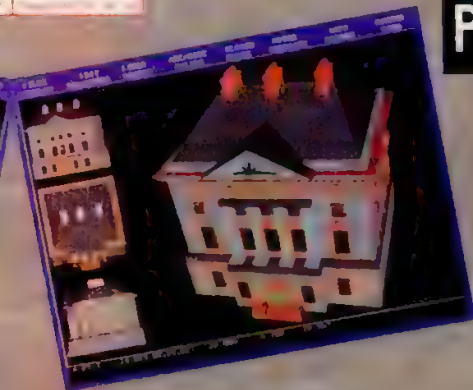


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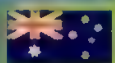


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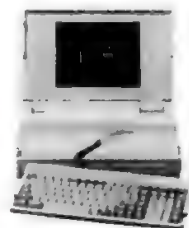
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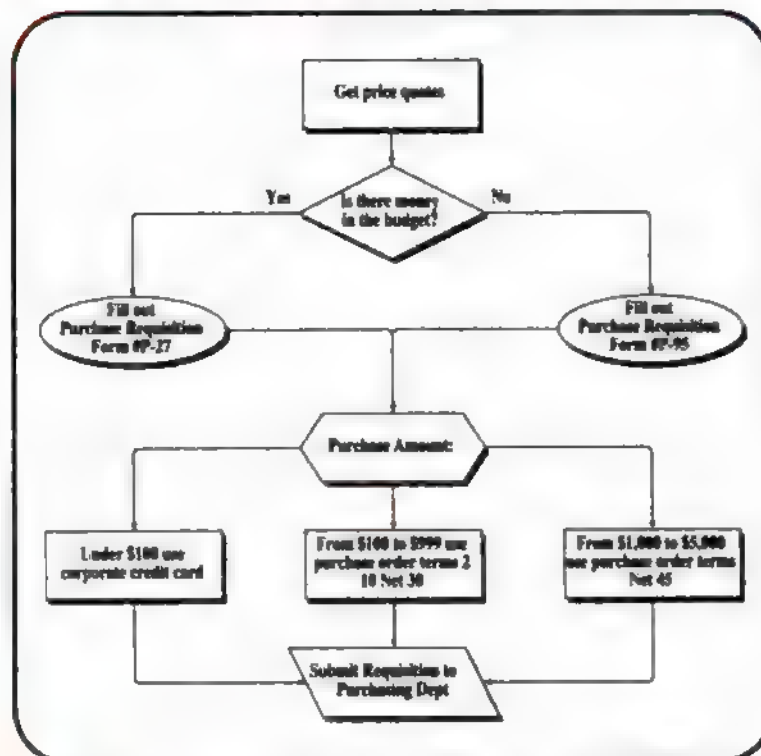
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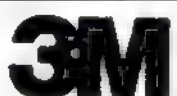
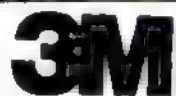
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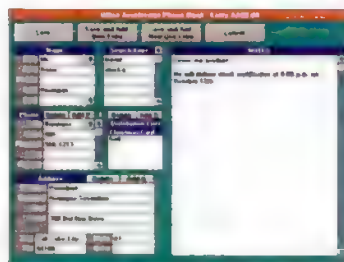
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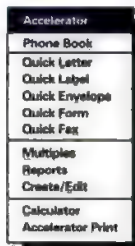


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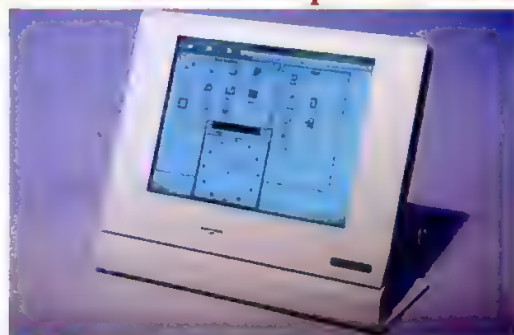
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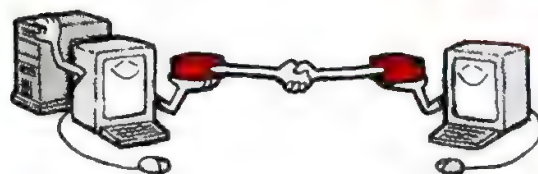
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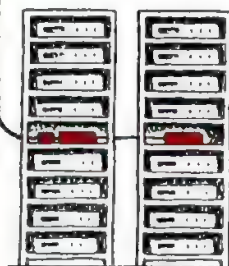
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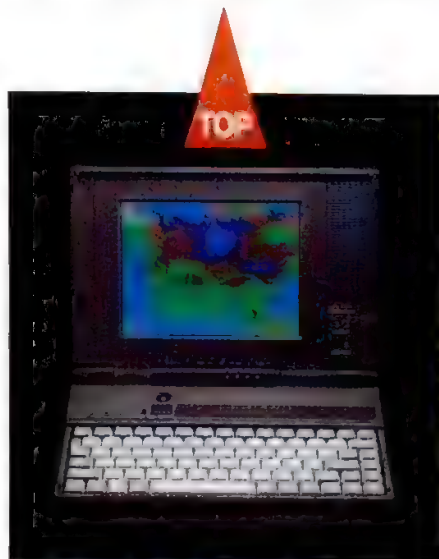
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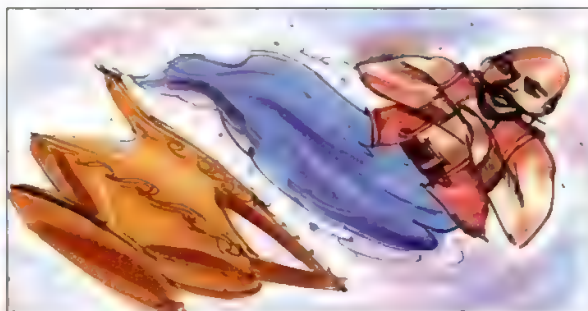


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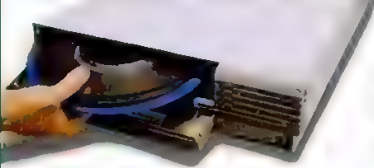
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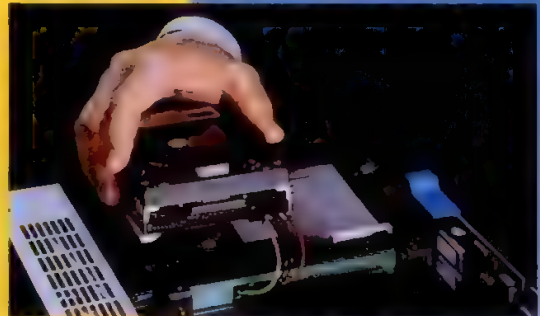
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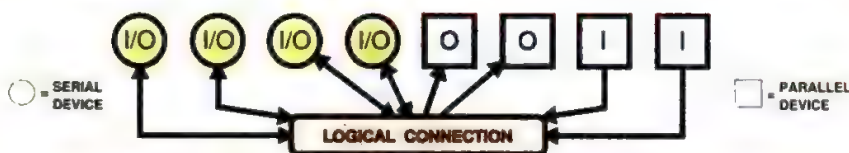
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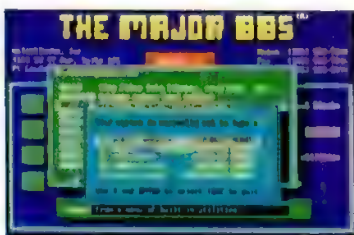
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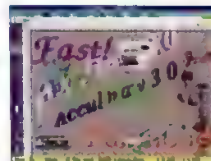
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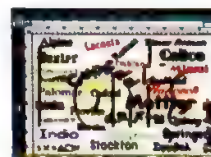
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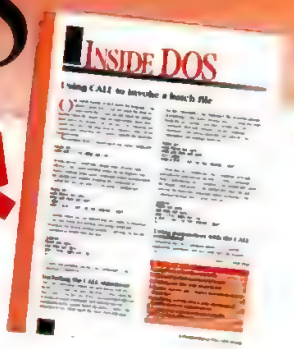
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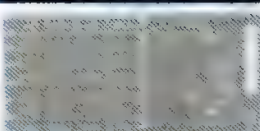
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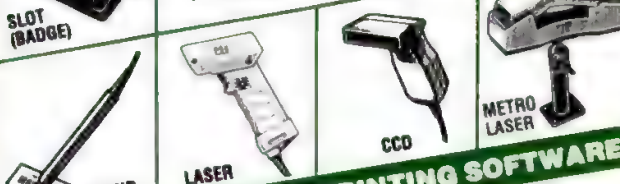
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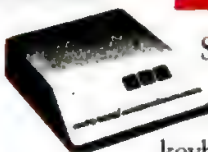
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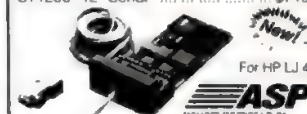
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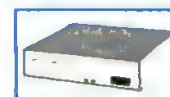
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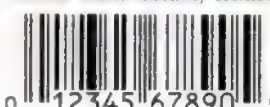
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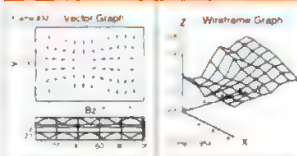
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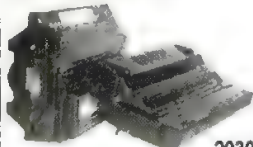
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1. Do you work in a DP/MIS department?
01. ☐ Yes 02. ☐ No

2. Please indicate your company or organization's primary business activity: (Check one only)

- 01. ☐ Manufacturer of Computer Equipment, Computers, Software
- 02. ☐ Manufacturer—Aerospace
- 03. ☐ Manufacturer—Other
- 04. ☐ Systems House
- 05. ☐ Computer Consultant
- 06. ☐ Computer Retailer/VAR/AD Distributor
- 07. ☐ Communications
- 08. ☐ Finance/Banking/Insurance/Real Estate/Accounting
- 09. ☐ Education
- 10. ☐ Government—Federal
- 11. ☐ Government—Non-Federal
- 12. ☐ Research and Development
- 13. ☐ Data Processing/Computer Service
- 14. ☐ Health/Medical/Legal Service
- 15. ☐ Engineering/Architecture

16. ☐ Agriculture/Construction/Mining/Oil/Transportation/Utilities

17. ☐ Non-Computer Retailer/Distributor

18. ☐ Other Business or Service

99. ☐ Other

3. Please indicate your primary business function: (Check one only)

- 01. ☐ DP/MIS
- 02. ☐ Systems, Programming
- 03. ☐ Communications
- 04. ☐ Engineering
- 05. ☐ Res./Dev./Scientific
- 06. ☐ Accounting/Finance
- 07. ☐ Computer Consulting
- 08. ☐ Purchasing
- 09. ☐ Operations
- 10. ☐ Production
- 11. ☐ Education/Training
- 12. ☐ Marketing/Sales
- 13. ☐ Medical/Legal
- 14. ☐ Admin./Mgmt.
- 99. ☐ Other

4. Is your company a reseller?
01. ☐ Yes 02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:

- 01. ☐ 10 or less 03. ☐ 26-99
- 02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office? (Check all that apply)

- 01. ☐ Linked to mainframe
- 02. ☐ Linked to mini
- 03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply)

- 01. ☐ IBM or Compatible PCs
- 02. ☐ IBM or Compatible Mainframes
- 03. ☐ IBM or Compatible Minis
- 04. ☐ Macintosh
- 05. ☐ CD-ROM
- 06. ☐ Windows

8. Do you plan to buy any PC Products?
01. ☐ Now

- 02. ☐ In 4 to 6 months
- 03. ☐ In 7 to 12 months
- 04. ☐ No definite plans

9. Number of Employees in your entire company:

- 01. ☐ 25 or less
- 02. ☐ 26-99
- 03. ☐ 100-499
- 04. ☐ 500-999
- 05. ☐ 1000 or more

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Coming Up

Power PCs

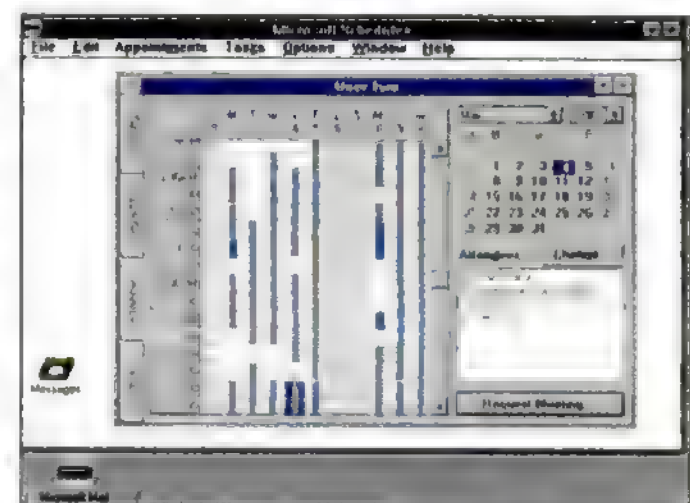
Operating at 66 megahertz, Intel's 486DX2/66 has established a new speed record for personal computing. *PC Magazine* will examine more than 70 of the most up-to-date systems designed around this advanced processor, including machines from Acer, Compaq, CompuAdd, Dell, Gateway 2000, IBM, Northgate, and Zeos.

Nonprogrammable Database Systems

With the emergence of several powerful new Windows packages, nonprogrammable database systems are being held to a higher standard. They may lack the programming tools of the professional systems, but many now feature relational capabilities as well as remarkably sophisticated query and report facilities. We review 11 DOS and Windows packages that offer extensive functionality and ease of use.

Workgroup Scheduling Software

As business schedules get more complex, the need to automate the time-consuming task of scheduling meetings becomes crucial. These days, offices could use a networked software product that handles the tedium of coordinating busy schedules. *PC Magazine* reviews Network Scheduler, CaLANDar, On-Time, and Futurus Team and looks at a wide variety of other scheduling products.



Microsoft's Schedule+ will be one of the products we examine in next issue's feature on network scheduling software.

Environments

Because bitmap fonts don't need to be rasterized before being displayed, and because each size of each font is designed for maximum legibility, bitmap fonts give us the two things we value most when working with fonts on our PCs—performance and appearance. The BITFONTS program, which we'll present in next issue's Environments column, demonstrates some of the basic functions for selecting and displaying text using OS/2 2.0 bitmap fonts. □

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After Hours

ENTERTAINMENT: Microsoft's Cinemania, Banner Blue Movie Guide **GAMES:** Buena Vista Software's Heaven & Earth; Sierra On-Line's Quest for Glory III; Davidson's Zoo Keeper; LucasFilm's Indiana Jones and the Fate of Atlantis

ENTERTAINMENT

Microsoft's Cinemania on CD-ROM: Everything but Popcorn for Film Buffs

BY DON TRIVETTE

Everything you ever wanted to know about movies is contained in Microsoft's Cinemania, a multimedia product for the avid film buff that lacks only a bag of popcorn and the 1992 releases.

You want reviews? Cinemania has 19,000 capsule reviews from *Leonard Maltin's Movie and Video Guide 1992*, as well as in-depth reviews of 500 classics and 245 recent boxoffice smashes taken from *The Motion Picture Movie Guide*. The selection ranges

for example, to find all ten movies starring Paul Newman and Joanne Woodward.

3,000 BIOS

You want biographies? Cinemania lists more than 3,000 movie stars, producers, and directors based on *Baseline's Encyclopedia of Film*. In the Topics section are hundreds of fascinating articles on subjects as diverse as neorealism, the Andy Hardy series, and special effects. The Glossary section defines such film terms as ambient light, best boy, and zoopraxiscope.

You want awards? Cine-

manian has a complete list of Academy Award winners since Oscar's debut in 1927.

You want photographs? Many award-winning films and performers are represented in the Photo/Sound Gallery, which contains 1,000 stills and hundreds of authentic sound clips. Hear classics like "Frankly, my dear . . ." and "Toto, I have a feeling we're not in Kansas. . ."

You want animation? Not yet. Microsoft did include an animated tutorial in Cinemania, but the good stuff—ac-

tual film clips and previews—is still missing.

All of these goodies are organized around an attractive and well-planned graphical interface in the guise of a remote control. Clicking a controller button brings up the selected feature. At the top of the screen are more buttons for functions, such as keeping a personal list of favorite films, an index, and a powerful search engine that can find anything on the disc. The controller's screen displays pictographic information on running time, availability on cassette, and rating.

Hot links and hyper-connections abound. While perusing a film review of Hitchcock's classic *North by Northwest*, for example, click on leading man Cary Grant's name for his photograph and

biography. The biography mentions screwball comedy; click on that and the glossary pops up with a definition and examples.

The only flaw in this product is the media. When you are accustomed to the instantaneousness of memory-resident and hard disk-based software, the 2 or 3 second delay found in all but the fastest CD-ROM drives is annoying.

Cinemania,

\$79.95. Requires: 386SX or higher, 2MB RAM, Microsoft Windows 3.0 or later with CD-ROM extensions, CD-ROM drive, sound card, speakers or headphone. Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 206-882-8080; 800-426-9400; fax, 206-883-8101.

Circle 460 on reader service card



Should you rent *Amadeus*? Read Leonard Maltin's capsule review or a detailed synopsis from *The Motion Picture Movie Guide*, both in Cinemania.

from 1914's *Tillie's Punctured Romance*, starring Charlie Chaplin, to last year's hit, *Terminator 2*. Films of 1992 will appear in an update later this year. Using filters, you can select films based on genres, directors, performers, awards, dates, and ratings. It's a snap,

Film Data On-Disk

For those who lack the hardware to run Cinemania, the Banner Blue Movie Guide (\$44.99) runs on almost any PC. It's incredibly fast, reasonably complete with 9,800 films, and currently on the shelf with many 1992 releases. The first film update, for registered owners, costs \$15.

The brevity of Banner Blue's reviews—usually just one sentence—may be all you need to jog your memory or whet your appetite. Films and performers are linked and cross-indexed: If you are looking at *King's Row*, for example, you have only to click on Ronald Reagan's name to bring up his 14 other pictures. A search feature selects films by a dozen different criteria. You can even record your own ratings directly in the database. The Banner Blue Movie Guide is a great traveling companion for a laptop computer. □

Banner Blue Movie Guide, \$44.99. Requires: 512K RAM, DOS 3.3 or later. Banner Blue Software Inc., 39500 Stevenson Pl., #204, Fremont, CA 94539; 510-794-6850; fax, 510-794-9152.

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GAMES

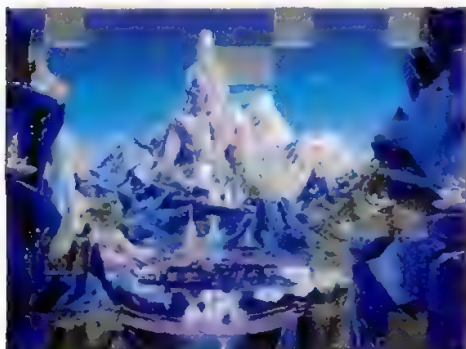
Heaven & Earth: New Age Fun For Die-Hard Puzzle Fans

BY JULIE COHEN

Warning: Sitting down for a quick session with Buena Vista Software's Heaven & Earth may kill your plans for the rest of the evening. This collection of mazes, card games, and hypnotic toys can keep puzzle fans staring at the screen till their eyes hurt.

Heaven & Earth's beautiful graphics and philosophical quotes give the game a New Age flavor. Tranquil mountains, starry nights, endless deserts, and cloud-filled skies make the gateways that link one puzzle to the next. Besides pretty pictures, the four sections—Illusions, Card Game, Pendulum, and Pilgrimage—give you more than 680 different puzzles to master.

The Illusions section consists of 12 types of mazes and puzzles, with four levels of difficulty. Each illusion challenges your spatial perception.



Every time you complete a step of Heaven & Earth's Pilgrimage, the black-and-white mountain gets a burst of color.

Many of the metaphors are variations on familiar themes: combining several oddly shaped blocks to form a cube or other shapes, for instance.

Others are refreshing and challenging. In Multiple Cursors, for example, your mouse controls as many as 21 cursors at once, picking up pieces and moving them to specific positions.

In the Card Game, a straightforward variant of solitaire, you amass points by placing cards in piles, matching any of the three elements on the face of each card: seasons, elements, or landscapes. Learning the game is easy; getting scores in the tens of thousands takes practice.

SHOOTING STARS

The joy of this game is the beautiful effects on many of the cards' faces. Suns and moons rise and set. A planet rotates, and a shooting star blazes a tiny trail across the landscape.

You may find Pendulum more a test of your patience than your game-playing skill. In this section, you must bring

a pendulum to rest over certain points on the screen, by moving the mouse back and forth at different speeds in order to control the pendulum's swing. Buena Vista bills this game as a relaxing, New Age computer toy, but I grew frustrated and

tense the harder I tried to control the pendulum. Once you practice the puzzles in each section, you can begin your 108-step Pilgrimage. You ad-

vance by completing puzzles that fall into the Pendulum, Card Game, and Illusions categories. Pilgrimage has the widest variety of challenges. The puzzles occur at random, so you must figure out the goal before you solve each one. The more you explore the other three sections, the better prepared you are for this one.

The Pilgrimage opens with a pixilated, black-and-white view of Shambhala, the promised land. As a reward for each step you complete, one square of the picture gets a burst of color; when the journey is complete, the image appears in full color. Each puzzle is introduced with a quote: Sources include the Talmud, Confucius, and Buddhist spiritual leader Chogyen Trungpa. You'll find them either inspiring or pretentious.

CUT CORNERS

Though the game's overall quality is good, the developers cut corners in two places. One—an unfinished help

screen in the Pendulum section—you'll notice; the other—some duplicated grids—you might not. An illusion entitled "Walking on the Edge," in the Gaining Losing section, for instance, uses the same grid as "Parallel Lives" in the Identity Maze category. In the former, the barriers take the form of black holes into which game pieces can fall; in the latter, the barriers simply block movement. But the path to the goal is identical.

After the novelty wears off (and even Tetris addicts get cured), Heaven & Earth will still deserve a place on a puzzler's hard disk: Individual puzzles take little time and keep the mind nimble.

Heaven & Earth, \$49.95.

Requires: 640K RAM, DOS 3.3 or later, 6MB hard disk space. Buena Vista Software, 500 S. Buena Vista St., Burbank, CA 91521; 818-567-5360, 800-688-1520; fax, 716-873-0906.

Circle 461 on reader service card

GAMES

Sierra On-Line's Quest for Glory III Blends Role Playing with Adventure

BY NEIL J. RUBENKING

In Sierra On-Line's *Quest for Glory III: Wages of War* (QG3), master storytellers Lori and Corey Cole transport you to Tarna in East Fricana, a land on the verge of a senseless war. Your mission: Prevent that war. You become a Hero, with the characteristics of a Fighter, Magic User, or Thief. You use your character's particular skills to thwart the forces of war.

Tarna is the city of Lions—six-limbed creatures, part man, part lion, with a

highly developed code of honor. Their allies, the nomadic Simbani warriors, live in the adjoining savannah, and the jungle is home to the mysterious Leopardmen, shape-changers whose village is concealed by magic.

The Simbani claim the Leopardmen stole their sacred Spear of Death, and that only the return of the Spear will bring peace. But the Leopardmen say the Simbani stole the holy Drum of Magic. The truth is more sinister than either group imagines.

Like the other *Quest for Glory* games, QG3 is a hybrid

See the Disk Spin.

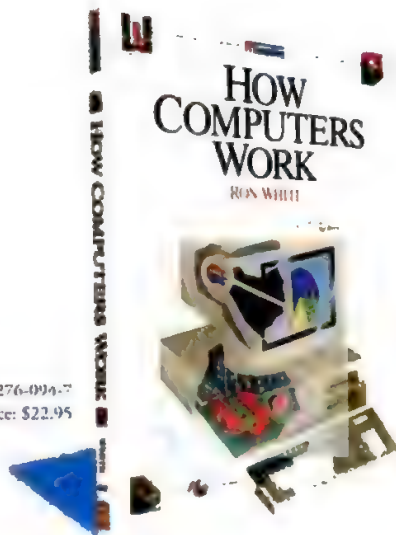


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ISBN: 1-56276-094-7
Price: \$22.95



PC/Computing
How Computers Work
by Ron White



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Quest

of Computer Role-Playing Game (CRPG) and graphic adventure. Your characters' attributes and abilities are defined by a list of statistics. Success in a task depends on skill levels, and practice improves those skills.

Like a graphic adventure, the game presents the character with a major goal and subplots that require thought and exploration. The two genres blend perfectly in QG3. A pop-psych interrogation by the Liontaur goddess Sekhmet even tests you to make sure you're in tune with your character.

NO TYPING

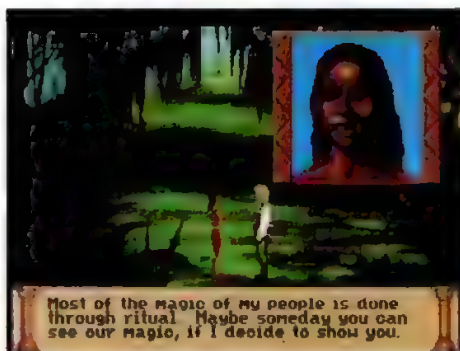
QG3 uses Sierra's standard no-typing interface. To talk to

a character, for instance, you select the mouth icon and click it on that character.

A rich soundtrack provides continuous African-style music via MIDI or sound board, lush, vivid backgrounds are hand-painted and digitized, and much of the on-screen action has realism provided by digitized video segments.

You'll meet many people and creatures—some helpful, some dangerous, and some silly. Wander the savannah long enough and you'll run into a pair of French Legionnaires who look and act

suspiciously like Laurel and Hardy. A starving Hero will meet (and eat) the Awful Waffle Walker, and a Hero sleeping under the stars may encounter Arne the Aardvark, a



As the character speaks, a large animated image of her face appears on the screen.

veritable gold mine of information. When you've just survived a round of combat with a Running Death dinosaur,

you'll welcome the comic relief.

QG3 is three games in one. Though the underlying story remains the same, the thief, magic user, and fighter approach it quite differently. Play all three, or import a character from a previous QG game. This is the only way to begin the game as a Paladin (a Fighter for Good). Save your character after QG3's cliff-hanger ending. At least two more Quest for Glory games are planned.

Quest for Glory III: Wages of War: \$69.95. Requires: 640K RAM, 7.5 MB hard disk space; DOS 3.3 or later. Sierra On-Line Inc., P.O. Box 485, Coarsegold, CA 93614; 209-683-4468; fax, 209-683-3633.

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CHILDREN'S GAMES

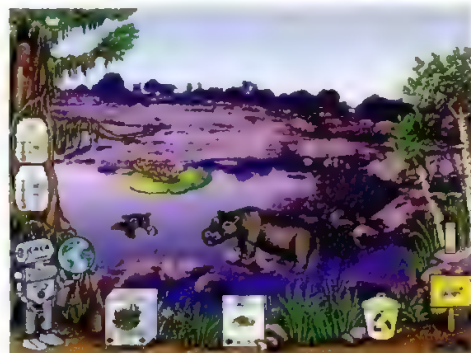
Zoo Keeper Teaches Kids To Care About Animals

BY CHARLES TAFT

If taking care of one animal helps teach a child caring and responsibility, imagine what children can learn from taking care of a whole zoo. Davidson & Associates' Zoo Keeper puts children, ages 6 to 11, in charge of more than 50 animals, from aardvarks to zebras, living in one of Zoo World's seven regions, including mountains, rain forests, and oceans and rivers.

Although managing Zoo World could be quite a job under the best of circumstances, four mischievous Troublemakers make the task more challenging. Greedy Gert, Brain Drain, The Meaniac, and Stir Crazy do their best to disrupt the animals by stealing food, littering, and changing

the climate. Young zookeepers must capture the Troublemakers and restore the environment. To do so, they adjust temperature and humidity, clean up the litter, feed the animals the proper meat and leaves, and establish the proper plant life—seaweed or mountain flowers, for instance—for the animals' habitats.



By correctly setting the environment, the zookeeper makes the hippopotamus's habitat hospitable.

The zookeeper in charge has two helpful assistants. Funk E. Monkey provides helpful advice and moral support and Zoonie the Robot gives you information on the animals and their environments. The command center, Zoo Central, provides you with two reference books—the Animal Book and the Zoo Book—as well as a place to relax between duties. As children successfully resolve problems, restore environments, and capture Troublemakers, they are promoted through the 18 employee levels at Zoo World, from lowly Cage Cleaner to Head Zoo Keeper.

Zoo Keeper gives children a true sense of the animal kingdom. There are digitized photographs of animals and habitats (including

spectacular close-ups). Animal sounds are provided by Zoo Life magazine and the television show "Zoo Life with Jack Hanna." These elements are combined with drawings of the animals to present delightful animated sequences.

Zoo Keeper falls squarely in the "edutainment" category. As children pursue the Troublemakers, they learn about the world's animals. (Did you know a crocodile can grow to 30 feet long, and that a hippopotamus can run as fast as a human?) The program explains how certain animals became extinct; the accompanying manual discusses a number of endangered animals and suggests ways to protect them.

Zoo Keeper, \$59.95. Requires: 640K RAM, DOS 3.3 or later, 8MB hard disk space. Davidson & Associates Inc., P.O. Box 2961, Torrance, CA 90509; 213-793-0600, 800-545-7677; fax, 213-310-793-0601.

Circle 463 on reader service card

GAMES

Indiana Jones's Latest Adventure: Solve Puzzles to Rescue Atlantis

BY ERIC BERLIN

In the man in the hat is back, and he'll probably return as long as there remain untouched myths.

In *Indiana Jones and the Fate of Atlantis*, our hero searches for Atlantis to save the world from the Nazis, who want to use the underwater city's power to rule the world.

The story sounds familiar, but some clever puzzles and good humor populate the latest installment in the *Indiana Jones* series. The programmers have shown some creativity as well, providing the

game with three paths. These paths demand that the same goals be accomplished, but the puzzles are different.

To get the help of a certain Algerian merchant on the Fists path, for instance, you must knock out the bad guys. On the Wits path, you'll have to be a bit more crafty; and on the Team path, you'll need the help of your smart-aleck female sidekick.

The interface, as with other LucasFilm games, is exceptionally easy to use—just click on a spot and Indy walks there.

Talking to people is simply a matter of clicking on the right snappy retort. Fistfights are accomplished with use of the keypad, but the fights grow repetitive very quickly. You may want to find a more creative

player noticing fine details on the screen. There is, for instance, an all-important arrowhead which went undiscovered for the longest time due to its small size and dark color. Too many puzzles

require this type of detail work. This fact alone makes *Indiana Jones and the Fate of Atlantis* a weaker link in the chain of LucasFilm games, but it still provides the humor, action, and puzzles it claims. □



As with LucasFilm games, *Indiana Jones and the Fate of Atlantis* has an intuitive interface.

way around the baddies—or simply throw a sucker punch and knock your opponent flat. The game's one failing is that several puzzles rely on the

Indiana Jones and the Fate of Atlantis, \$59.95. Requires: 540K RAM, 9.4MB hard disk space, DOS 3.0 or later.

LucasFilm Games, P.O. Box 10307, San Rafael, CA 94912; 415-721-3300, 800-782-7927; fax, 415-456-4381.

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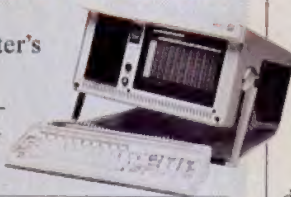
Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Robin Raskin

10 YEARS AGO IN PC MAGAZINE

At 26 pounds, Colby Computer's PC1 Portable Conversion resulted in many bruised thighs.



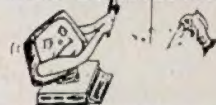
The PCychiatrist: MIT's Eliza, written in BASIC, occupied 64K of RAM and cost \$25. It got us riled up about AI and made us believe we could really confide in our machines.

Some things never change: One out of every ten executives is actually afraid of computers (says author Barry Owen, writing about buying PCs for executives).

Lather, Rinse, Repeat

When you run Disk Technician Gold and The Norton Desktop for Windows together, NDW's screen saver kicks on, accessing the disk. The DTG icon appears whenever the disk is accessed, and wakes up the screen saver.

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French magazine rates public toilets

PARIS (AP) — To sit or not to sit? A rating of the French capital's public toilets may help Parisians and tourists arrive at a better-informed decision.

The monthly health magazine Que Choisir Sante reviewed the facilities.



See, we're not the only ones who run benchmark tests.

BUZZWORD WATCH

channel-agile Refers to the computer's ability to detect the type of communications protocol it is receiving and adapt accordingly.

First heard: Robert Carr, GO Corp.

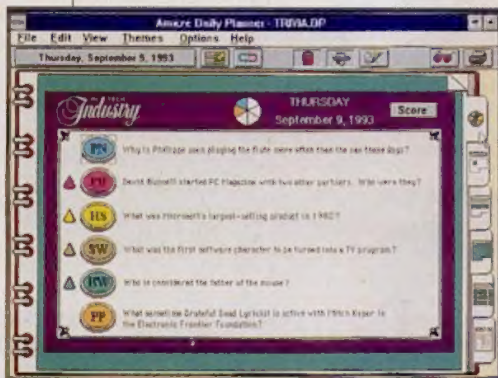
redzoning Getting within striking distance of the goal. So far, this term has been limited to football chatter, but we can't wait for the first vendors to call and tell us they've entered the redzone.

First heard: National Public Radio



Do they come filleted or poached?

Computers get trivial: The hot game on the Comdex show floor was Amaze's computer-industry edition of Trivial Pursuit. How computer-hip are you?



He has a bad back. • J. Edlin and T. Gold. • Premium Pack (Z-80 card, 16K board, CPM). • Carmen Sandiego. • Doug Englebart. • John Perry Barlow.

ARF Interactive

What does the NT in Windows NT really stand for?

- (1) Not There.
- (2) Nervous Technicians.
- (3) New Toy.

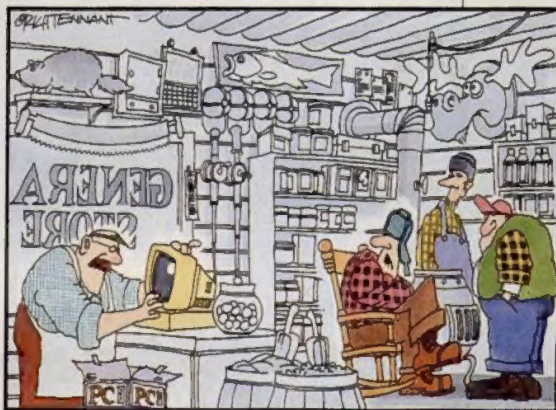
Send us your best hunches. We'll print them on these pages.

If your entry is used in Abort, Retry, Fail? we'll send you \$50 and a PC Magazine T-shirt. Winners this issue: Ben Gottesman (DTG/NDW gridlock), Gasper Holland (wife and mhz for sale), Larry Groshart (computers vs. fish).

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—SAN ANTONIO EXPRESS



RICHARD TENNANT

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4. COMPAQ (8.00)	4. COMPAQ (7.71)	4. IBM (8.01)	4. IBM (8.54)	4. IBM (8.91)	4. IBM (7.98)	4. IBM (7.38)	4. IBM (7.88)

Survey was independently conducted by Reliability Ratings, Inc., a subscriber-based research firm that does business with most of the FORTUNE 500.

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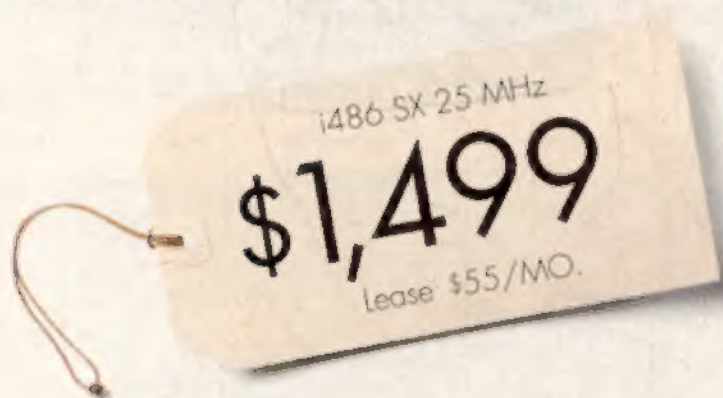
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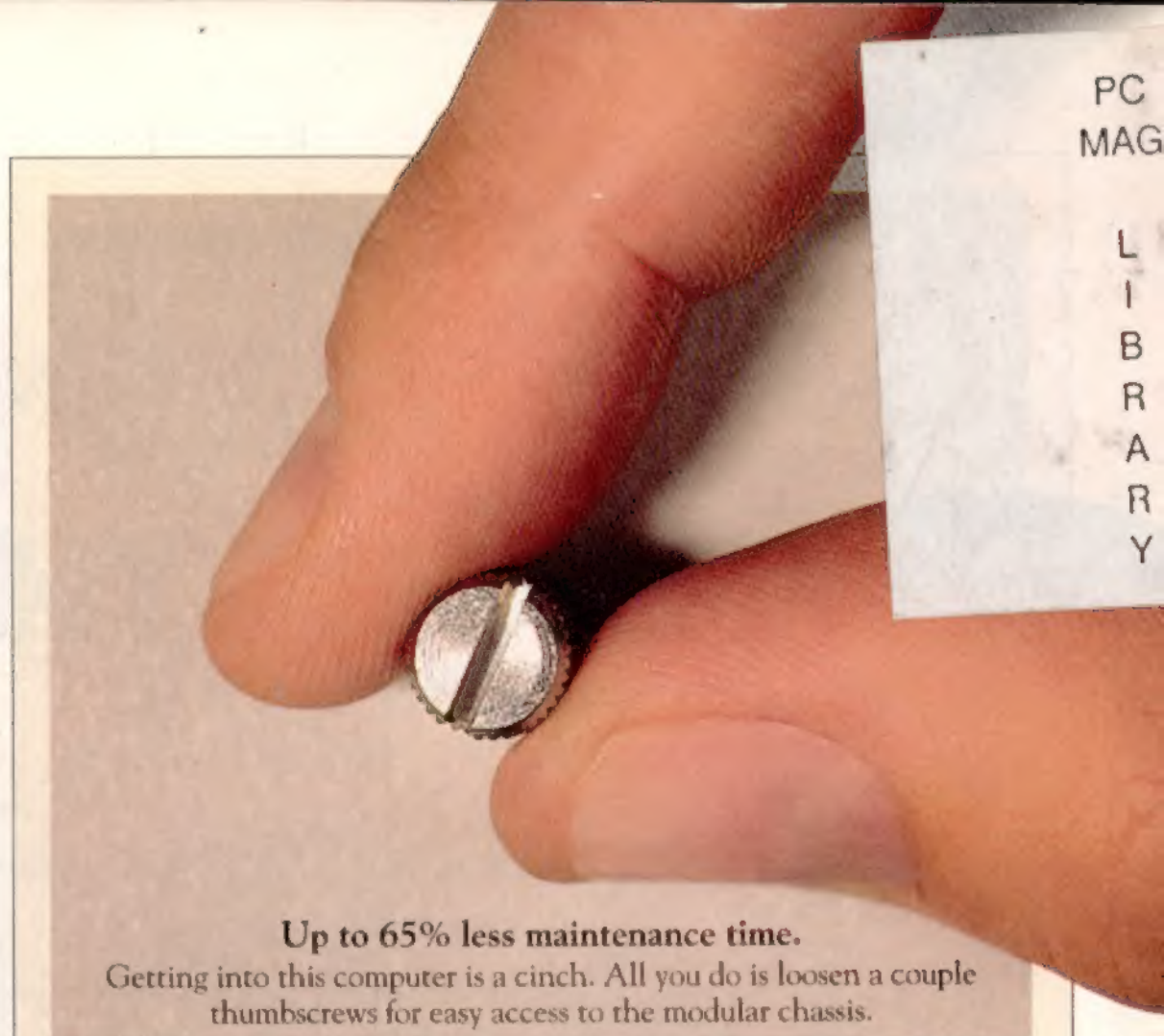


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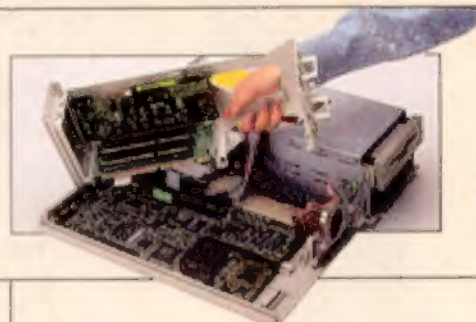
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